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ERRATA.

Page 10 line 8 for "*Haemotomyzus*" read "*Haematomyzus*"
,, 29 ,, 20 ,, "*leucoceleanus*" read "*leucocelaenus*"
,, 50 11 lines from end for "*Euphractes*" read "*Euphractus*"
,, 92 lines 10 and 11 for "C. H. N. Jackson" read "H. M. Lloyd"
,, 132 line 6 for "*Stomoxys minuta*" read "*Lyperosia* (*Stomoxys*) *minuta*"
,, 158 8 lines from end for "thiodiphenolamine" read "thiodiphenylamine"
,, 213 line 3 for "*Dinopsylla*" read "*Dinopsyllus*"
,, 214 last line for "*A. pictipennis*, Phil. (*albitarsis*, Arrib.)" read "*A. albitarsis*, Arrib."
,, 271 line 2 for "*Phlebotomus longiductus*" read "*Phlebotomus chinensis longiductus*"

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REVIEW
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SUN (C. J.), YAO (Y. T.), CHU (H. J.) & WU (C. C.). **Natural Infection of *Phlebotomus chinensis* with Flagellates morphologically indistinguishable from those of *Leishmania donovani*.**—*Chin. med. J.* **50** no. 7 pp. 911–916, 2 pls., 1 sketch map, 25 refs. Peiping, July 1936.

In China, cases of kala-azar are widely distributed in the region north of the Yangtsze River, where sandflies also occur. An investigation carried out between 6th June and 16th July 1935 in a village of North Kiangsu revealed 46 cases in 30 houses out of a total population of 237 living in 39 houses. In 9 surveys made at intervals of about 4 days, 769 sandflies (684 females and 85 males) were collected; the species were *Phlebotomus chinensis*, Newst., which was the most abundant, *P. sergenti* var. *mongolensis*, Sinton, *P. squamirostris*, Newst., and a fourth species, which is to be described in a separate paper. Dissections of 421 females of *P. chinensis* caught in houses where there were cases of kala-azar revealed flagellates in the mid-guts of 7. These flagellates were indistinguishable from those of *Leishmania donovani* found in the midguts of 5 out of 73 laboratory-bred sandflies of the same species fed experimentally on infected persons. Inoculation of material from 2 positive sandflies into 2 striped hamsters [*Cricetulus griseus*] gave negative results. O-shaped bodies were found in the guts of 26 of the sandflies, most of which were taken in the 3 houses from which the 7 infected ones were obtained. According to R. O. A. Smith, these are true Leishman-Donovan bodies and not degenerating ones as seen in old N.N.N. cultures.

CORRADETTI (A.). **Ricerche sui flebotomi della zona endemica di leishmaniosi cutanea in Abruzzo.** [Investigations on Sandflies of the endemic Zone of cutaneous Leishmaniasis in Abruzzo.]—*Ann. Igiene* **46** no. 1 pp. 13–17, 6 refs. Rome, January 1936. [Recd. October 1936.]

One of the most important foci of cutaneous leishmaniasis in the Mediterranean basin is in the Abruzzo region of Central Italy. Sandflies collected in the two villages that are most affected by the disease

were all *Phlebotomus perfiliewi*, Parr. (*macedonicus*, Adl. & Thdr.). It was not possible to find forms of flagellates that could be connected with leishmaniasis in 486 sandflies collected in one of the villages in dwellings of families with actual cases of oriental sore. Precipitin tests showed that 3 of 51 sandflies taken in both villages in animal quarters and 82 of 83 captured in houses had fed on man, and all the others on cattle or horses. It appears, therefore, that the sandflies do not tend to change their quarters to digest the blood taken.

De Meillon (B.). **The Distribution of** ***Anopheles gambiae*** **and** ***A. funestus*** **in Natal.**—*Publ. S. Afr. Inst. med. Res.* no. 38 pp. 133–135, 1 map, 2 refs. Johannesburg, 1936.

From a knowledge of the climatic factors that regulate the distribution of *Anopheles gambiae*, Giles, and *A. funestus*, Giles, in the Transvaal [*cf. R.A.E.*, B **22** 53], it would appear that the whole coastal belt of Natal is suitable for permanent breeding of both species, but it has been found that their range is restricted in normal years by vegetation and by the physical features of the region. Except in the native reserves, which are bare and overstocked with cattle, rain-water pools are shaded by natural vegetation, which prevents widespread breeding of *A. gambiae*. Moreover, the mountainous and hilly nature of the country does not lend itself to the formation of suitable pools. Prolonged drought that destroys vegetation followed by rains in midsummer would favour more abundant breeding, and this is thought to have been one of the important causes of the epidemic of malaria in 1931–32.

A. funestus does not occur south of the Umhlatuzi River, because the coastal belt narrows and the small streams are constantly flushed. Larger rivers have sandy beds and banks with very little vegetation and are consequently unsuitable as breeding places.

De Meillon (B.). **South African Simuliidae. Part III. New and unrecorded Species.**—*Publ. S. Afr. Inst. med. Res.* no. 38 pp. 208–215, 3 pls., 2 refs. Johannesburg, 1936.

In this continued paper [*cf. R.A.E.*, B **23** 230], descriptions are given of the adults of both sexes and pupae of *Simulium tisiphone*, sp. n., and *S. pseudomedusaeformis*, sp. n., and of the male and pupa of *S. impukane*, sp. n., all from Zululand. *S. alcocki*, Pom., is also recorded from Zululand. *S. pseudomedusaeformis* was erroneously recorded in the preceding part of this paper [*loc. cit.*] as *S. medusaeformis*, Pom.; the specimens concerned came from the Cape and the Transvaal.

Roubaud (E.) & Treillard (M.). **Sur une variété portugaise de l'*****Anopheles maculipennis*** **(groupe** ***atroparvus*****).**—*Bull. Soc. Path. exot.* **29** no. 7 pp. 726–730, 2 figs., 1 ref. Paris, 1936.

Since the beginning of March, a strain of *Anopheles maculipennis*, Mg., obtained from Portugal has been reared through successive generations in the laboratory. It very closely resembles race *atroparvus*, van Thiel, but since the slight differences appear to be constant, the authors propose naming it *cambournaci*. Fertile offspring were obtained when females of the latter race paired with males of a strain of the former from La Vendée and when the hybrid females obtained were paired with hybrid males or pure males of both the original races; the eggs

of the first hybrid generation resembled those of the original Portuguese strain. The Portuguese race is zoophilous (its maxillary index being about 16) and stenogamic, but the fact that the females received at the beginning of March all laid eggs after a single blood meal at room temperature suggests that the winter diapause depends on temperature only and that the race is homodynamic.

RASTÉGAIEFF (E.). **Toxicité des piqûres d'*Ornithodorus lahorensis*, Neumann, 1908.**—*Bull. Soc. Path. exot.* **29** no. 7 pp. 730–732. Paris, 1936. *Ornithodorus lahorensis* **Neumann, 1908, vecteur des hémoparasites du mouton : *Anaplasma ovis* et *Theileria recondita*.**—*T.c.* pp. 732–733.

A sheep that was being used in a study of the biology of *Ornithodorus lahorensis*, Neum., in Russia died with symptoms of complete paralysis of the feet. Nearly 200 larvae of the tick had been placed on the sheep, on which they had undergone 3 moults. A fourth moult took place 3 weeks after the beginning of the experiment, and the sheep died 2½ days after the appearance of engorged nymphs. *Anaplasma ovis* and *Theileria ovis* (*recondita*) may give rise to anaemia and wasting but never to paralysis, and in this case death is believed to have been due to a general toxaemia caused by the bites of the tick.

Further experiments with ticks of this species on a goat and a sheep confirmed the hypothesis that the species of *Theileria* previously transmitted to a kid [*R.A.E.*, B **23** 91] was *T. ovis* and that this tick can transmit both this parasite and *A. ovis*.

ROUBAUD (E.) & COLAS-BELCOUR (J.). **Influence favorable d'une légumineuse fixatrice d'azote sur le développement d'un plankton nitrophile propice aux larves d'anophèles.**—*Bull. Soc. Path. exot.* **29** no. 7 pp. 798–805, 7 refs. Paris, 1936.

In flooded meadows, which are one of the common types of breeding places for numerous species of Anophelines, especially *Anopheles maculipennis*, Mg., the development of the larvae is assured by the presence of bacteria, flagellates, microscopic algae, etc., which are maintained by the complex action of soil and vegetation. The experiments described were undertaken to determine the possible effect of leguminous plants (which are responsible for the fixation of nitrogen) on the development of nitrophilous protozoa, such as *Euglena*, with a view to discovering conditions under which the protozoa necessary as food for mosquito larvae would develop readily in breeding media. Larvae of *Anopheles maculipennis* var. *cambournaci*, Roub. & Treill., were reared in jars of water containing various combinations of *Euglena gracilis*, *Chilomonas paramecium*, clover (*Trifolium repens*), humus, turf, and germinating lentils, and the percentage that pupated was noted. The best results were obtained in jars in which the water was covered with *C. paramecium* and *E. gracilis* and in which there was a tuft of clover either in a porous pot, or with its roots partly immersed directly in the water. It would seem probable that nitrates are released from the roots of the clover and are used by the *Euglena* and green algae. The effect of nitrates on the development of *Chilomonas* is not yet understood. Nitrates were found to occur only in the jars in which clover had been present for several days. Other leguminous plants, particularly those that normally grow in damp soils, could probably be substituted for the clover with equally good results.

HACKETT (L. W.) & BATES (M.). **Swarming of the Males of certain European Anophelines in Captivity.**—*Nature* **138** no. 3490 pp. 506–507, 1 ref. London, 19th September 1936.

The authors describe the swarming of the males of the typical race of *Anopheles maculipennis*, Mg., in a cage of wire netting about 34 ft. long by 16 ft. wide by 19½ ft. high in the open in Albania, in which was being reared under conditions as natural as possible. Swarming of *A. superpictus*, Grassi, *A. sacharovi*, Favr (*elutus*, Edw.) and *A. claviger*, Mg. (*bifurcatus*, auct.) took place in a room 8½ ft. long by 7½ ft. wide by 8¼ ft. high, which was insulated so far as possible from external stimuli and in which the temperature varied daily within 5°C. [9°F.] of a mean of 20°C. [68°F.] and the humidity ranged from 84 to 94 per cent.; in all cases fertile eggs were obtained. About 1,000 adults of the typical race of *A. maculipennis* were also released in this room, but no sexual activity was observed.

SABIT AKALIN (M.). **Ein atypisches Verhalten bei den Eiern von** *Anopheles elutus*. [Atypical Characters in Eggs of *A. sacharovi*.]—*Arch. Schiffs- u. Tropenhyg.* **40** no. 11 pp. 514–516, 19 figs. Leipzig, 1936.

A very dark female of *Anopheles sacharovi*, Favr (*elutus*, Edw.), taken in western Anatolia, laid 193 eggs, all of which differed from those typical of this species by an exochorion very dark in colour as compared with the usual grey and by other characters. No peculiarities were noticed in the resulting adults of both sexes. Apart from the above abnormal eggs, it was noticed that among the normal eggs of *A. sacharovi* about 10 per cent., even from a given female, had an oblique band or were black like those of *A. maculipennis* var. *melanoon*, Hackett.

GASCHEN (H.) & RAYNAL (J.). **Recherches sur les affinités trophiques des anophèles d'Indochine. (Première note.)** *Anopheles hyrcanus* **var.** *sinensis*.—*Ann. Inst. Pasteur* **57** no. 3 pp. 311–324, 3 refs. Paris, September 1936.

This note forms the first part of a work on the food-preferences of Anophelines of northern Indo-China and deals exclusively with a study of 1,096 females of *Anopheles hyrcanus* var. *sinensis*, Wied. The total average maxillary index (calculated from both maxillae) was 15·14 [*cf. R.A.E.*, B **21** 140]. More than 92 per cent. had an index of 14 or more, and there was no evidence that the 8 per cent. with an index of less than 14 were anthropophilous, for among those in this category caught in houses the percentages that had engorged on man or animals only were 12·9 and 9·8, respectively. Of the females of all categories used for precipitin tests, the percentages that contained the blood of man or animals only were 8·8 and 69·7 for those caught in houses and 2·3 and 86·7 for those caught in stables. This species is clearly zoophilous; it is not attracted to man unless animals are absent or external conditions force it to remain for long periods in dwellings. The average maxillary indices for females taken in eight different localities were all in the neighbourhood of 15; among those engorged on animals the indices varied from 12 to 20. A detailed study of the conditions in each of these localities indicates that the blood ingested depends on the species

of animal present. Horses are the chief source of blood in certain towns, pigs in suburban localities, and cattle and buffalo in rural areas. The presence of a large number of bovines brings about complete deviation of this mosquito, which seems to prefer buffalo to cattle. It does not appear to be concerned in these regions in the transmission of malaria.

GALLIARD (H.). **La filariose à *Wuchereria bancrofti* dans la région de Hanoi (Tonkin).**—*Bull. Soc. méd. chir. Indochine* **14** no. 5 pp. 439–441, 1 ref. Hanoi, 1936.

After discussing the incidence of *Filaria* (*Wuchereria*) *bancrofti* in the blood of patients at a hospital at Hanoi that serves the city and the surrounding districts, the author states that he has not yet been able to ascertain the rate of infection of mosquitos in nature. He has, however, obtained complete development of the larvae of the parasite in *Culex fatigans*, Wied. [*cf. R.A.E.*, B **24** 216] and *Anopheles hyrcanus*, Pall., his observations confirming what is known of its development and showing that it is not *F. malayi*. Attempts to infect *Armigeres obturbans*, Wlk., *Aëdes aegypti*, L, and *A. albopictus*, Skuse, have so far been unsuccessful.

NGUYÊN-CÔNG-TIÊU. **Contribution à l'étude des moyens de destruction des moustiques.**—*Bull. écon. Indochine* **39** pp. 345–347. Hanoi, 1936.

Strips of white and coloured paper covered with adhesive to catch mosquitoes were pasted vertically in dark places on the walls of rooms in a house in Hanoi. Particulars of the rooms and of the mosquitos caught in each are given in a table. Only species of the genus *Culex* were taken. More mosquitos were attracted to the coloured papers than to the white, and they were always more numerous on the lower part of the walls.

GORE (Ramkrishna N.). **A Village Mosquito-trap.**—*Indian med. Gaz.* **71** no. 8 pp. 460–461, 3 figs. Calcutta, August 1936.

The trap described consists of a large earthenware pot about 7 inches in diameter at the neck and four rectangular pieces of cloth, which are hung down inside the pot to form a cylinder that reaches to within 4 inches of the bottom and so allows mosquitos seeking shelter easy access to the darker parts. Small stones attached by string to the upper edges of the pieces of cloth (which project from the mouth of the pot) hang down outside the pot and hold them in position. The trap is placed at night in a corner that has been found to be a resting place of mosquitos ; twice between 7 and 8·30 a.m. mosquitos in other parts of the room are disturbed, as this increases the catch in the trap. By 10 a.m. the mosquitos are at rest. A cover is placed over the mouth of the pot to retain them, and the pieces of cloth are shaken and withdrawn by means of the string.

ZUELZER (M.). ***Culex*, a new Vector of *Spirochaeta gallinarum*.**—*J. trop. Med. Hyg.* **39** no. 17 p. 204. London, 1st September 1936.

Investigation of an extensive epidemic of spirochaetosis (caused by *Spirochaeta gallinarum*) among fowls on the Baltic coast of Germany, where the disease has not previously been observed, failed to reveal

the presence of *Argas persicus*, Oken. Precipitin tests showed fowl blood in mosquitos of the genus *Culex* found in poultry houses, and healthy fowls on which the mosquitos were allowed to feed became infected 30 days later. As the spirochaetes transmitted by the mosquitos were found to be transmissible experimentally by *A. persicus*, there is no reason to suppose that they belong to a special strain. Some of the diseased fowls were heavily infested with mites of the genus *Dermanyssus*, which were also shown to be capable of transmitting the spirochaete, but as transmission did not occur later than 48 hours after the infecting feed, it was purely mechanical, whereas in experiments with the other two vectors it was cyclical.

Horsfall (W. R.). **Occurrence and Sequence of Mosquitoes in south-eastern Arkansas in 1935.**—*J. econ. Ent.* **29** no. 4 pp. 676–679. Menasha, Wis., August 1936.

A list is given of 23 species of mosquitos collected in the south-east of Arkansas during 1935, showing the larval and adult habitats and the times of emergence. The more troublesome species, in order of importance, were *Aëdes canadensis*, Theo., *A. vexans*, Mg., *Culex fatigans*, Wied. (*quinquefasciatus*, auct.), *Anopheles quadrimaculatus*, Say, *A. punctipennis*, Say, *C. territans*, Wlk., *Psorophora varipes*, Coq., and *P. columbiae*, D. & K. The seasonal prevalence of these species, and of one or two of those that are of local importance at certain seasons, is briefly discussed.

Morris (H.), Martin (J. A.) & Oglesby (W. T.). **An Attempt to transmit Anaplasmosis by Biting Flies.**—*J. Amer. vet. med. Ass.* **89** no. 2 pp. 169–175, 13 refs. Chicago, Ill., August 1936.

The literature on the transmission of anaplasmosis of cattle (*Anaplasma marginale*) is reviewed, and an account is given of experiments carried out in Louisiana in 1930–32 in which attempts were made to transmit the disease by the interrupted feeding of *Tabanus atratus*, F., *T. fuscicostatus*, Hine, and *Lyperosia* (*Haematobia*) *irritans*, L. The results were negative, although the cows were kept under observation for 80–100 days and were subsequently proved by injection to be susceptible. In a preliminary experiment with *T. atratus* in 1929, marginal dots appeared in the erythrocytes in the blood of the cow and a rise of 2° in temperature was recorded 25 days after 15 flies had fed, but there was no good clinical picture of the disease. The dots continued to appear at intervals of about 16 days for several months.

Madsen (D. E.), Knowlton (G. F.) & Rowe (J. A.). **Further Studies on Transmission of Equine Encephalomyelitis by Mosquitoes.**—*J. Amer. vet. med. Ass.* **89** no. 2 pp. 187–196, 7 refs. Chicago, Ill., August 1936.

An account is given of further experiments on the transmission of equine encephalomyelitis by females of *Aëdes nigromaculis*, Ludl., and *A. dorsalis*, Mg. [*cf. R.A.E.*, B **23** 197] caught in Utah, to determine at what period of the disease the mosquitos can obtain the virus from the peripheral blood and for what length of time they can transmit it. The technique of the experiments is described. Both mosquitos were fed on infected guineapigs at intervals of from 12 to 72 hours after the

latter had been injected with the virus of the western type, and were allowed to bite healthy guineapigs after intervals ranging from 3 to 24–25 days. In the tests with *A. nigromaculis*, 16 out of 275 guineapigs became infected, all the positive results being obtained with mosquitos that had fed 18–66 hours after injection of the infected guineapig and had bitten healthy animals 4–10 days after their infecting feed. In those with *A. dorsalis*, only 6 out of 244 guineapigs became infected, the positive results being obtained with mosquitos that had fed 18–42 hours after injection of the infected guineapig and had bitten healthy animals 9–19 days after the infecting feed. In the former case, the highest percentage of positive results was obtained on the 6th, 7th and 8th days ; in the latter, the number of positive transmissions was so low that conclusions are not definite, though the peak would seem most likely to occur on the 12th-14th days. A limited number of attempts to transmit the disease to horses by means of these two local mosquitos were unsuccessful.

Plague Infection discovered in Fleas and Lice taken from Marmots in Montana and in a Marmot from Utah.—*Publ. Hlth Rep.* **51** no. 34 pp. 1159–1160. Washington, D.C., 21st August 1936.

A report received from C. R. Eskey records the discovery of plague infection in fleas and lice taken from marmots [*Marmota flaviventris*] shot in Montana in July 1936. Totals of 153 fleas and 26 lice were collected in separate bottles and inoculated into guineapigs, which died in 6 and 3 days respectively. Secondary inoculations and cultures gave rise to typical plague reactions. Plague was also diagnosed in a sick marmot killed in Utah in the same month ; this is believed to be the first record of plague infection in a marmot in the United States.

de Vogel (W. T.). **Recherches faites aux Indes Néerlandaises sur la durée pendant laquelle la puce *X. cheopis* infectée de peste peut, dans les conditions climatologiques de l'Ile de Java, transmettre l'infection.**—*Bull. Off. int. Hyg. publ.* **28** no. 8 pp. 1525–1543, 5 diagr. (2 fldg), 1 map, 2 refs. Paris, August 1936.

The question whether plague was brought from Calcutta to Peru by infected fleas carried in bales of jute sacks in two vessels in 1931 and 1933 [*cf. R.A.E.*, B **23** 182] is discussed. From the data obtainable, it appears improbable that there was a plague epizootic among rats on board the ships. The literature on the longevity of infected and uninfected fleas (with particular reference to work done in Java) and on their ability to carry infection for long distances when separated from their hosts is reviewed.

The jute sacks in question were first stacked in large bundles and then subjected to strong hydraulic pressure and bound with bands of steel. The temperature of the bales would be that prevailing in Calcutta and its environs from the time the sacks were baled until the vessels put to sea. The average temperature of the water (which at sea differs little from that of the air) at various points in the course of the voyages of the two vessels, and the dates at which they were encountered, are shown in graphs. It is estimated that the temperature of the holds, which are kept constantly heated by the ship's furnaces, are at least 4°C. [7·2°F.] higher than that of the sea, and, since jute is subject to fermentation, it is likely that holds containing this substance, although specially ventilated, are at least 1°C. [1·8°F.] higher than normal. As the

conductivity of jute is low, there is probably a lag of at least 3 days before the temperature within the bales reaches that of the surrounding atmosphere.

Research has indicated that the period during which infected fleas can transmit plague by biting becomes shorter as the temperature rises. In Bombay, for example, it was found that during the cool months of December–February, when the plague epidemic occurs, this period was 15 days, whereas in the hot months of April, May and June, when the average temperature rises to 32°C. [89·6°F.] and the epidemic declines, it is only 7 days.

One vesssel carrying sacks baled at Calcutta at temperatures of 33–35°C. [91·4–95°F.] travelled for the first 14 days through seas with a temperature of 28–29°C. [82·4–84·2°F.], so that during this time the temperature of the holds did not fall below 32°C. [89·6°F.] and for 17 days the temperature within the bales could not have fallen as low as this. From the researches cited above it is evident that any infected fleas in the bales would have lost their infectivity during this period, even if they had survived the voyage. Examination of the periods of high temperature through which the other vessel passed in the light of the experiments carried out in Java on the period of infectivity of fleas also shows that even if fleas survived they would not have been infective.

The author considers it far more likely that the bales became infested with infected fleas from local rats (which have a preference for making their nests in jute) during the time they were warehoused in Peru before distribution. This would explain why no cases of plague occurred among the stevedores [*cf.* **23** 183], and why infection occurred after the removal of the bales from the warehouses situated in the central zone of Peru, where plague has persisted since its first introduction [*cf.* **21** 39], whereas no cases of plague followed the discharge of bales at two ports situated outside this zone. The greater virulence of a strain can hardly be considered a sufficient reason for assuming that it was imported, since strains of all degrees of virulence have been isolated in the course of the same epidemic or epizootic in other countries.

[Arkhangel'skiĭ (N. N.).] **Архангельский (Н. Н.). Hydrogen Sulphide as a Means of Plant Protection.** [*In Russian.*]—*Bull. Plant. Prot.* (3, Contr. Meas. Implem.) no. 6 pp. 9–47, 62 refs. Leningrad, 1935. (With a Summary in English.) [Recd. 1936.]

In the course of experiments in the northern Caucasus on the uses of hydrogen sulphide as a fumigant [*R.A.E.*, A **25** 7], it was found to give an average of over 80 per cent. mortality of ground squirrels [*Citellus*] in their burrows when used at the rate of about 4 gm. per burrow. Its action on the fleas of these rodents was then tested in the laboratory at a concentration of 2–6 per cent. If the full concentration of the gas was introduced into the chamber at once, the fleas ceased to move immediately and died within 30–40 minutes. When the gas was gradually released, the fleas had all died in 6 hours. Lice [*Pediculus humanus*, L.] became motionless as soon as they were exposed to a 4–6 per cent. concentration and died in 2 hours, and in field tests the fumigant was successfully used for treating clothes under a tarpaulin cover, the lice being destroyed irrespective of the temperature and without damage to the clothes.

Jones (H. A.) & Smith (C. M.). **Derris and Cube. Approximate Chemical Evaluation of their Toxicity.**—*Soap* 1936 reprint 3 pp. New York, June 1936.

The authors have evolved a method for estimating, from the percentage of rotenone and of total extractives, the toxicity to house-flies [*Musca domestica*, L.] of a given sample of derris or cubé [*Lonchocarpus*] root, by using a factor calculated from figures obtained in experiments already noticed [*R.A.E.*, A **23** 453], in which extracts of a number of samples of derris and cubé root, were made with carbon tetrachloride, benzene and acetone. A figure for the toxicity attributable to extractives other than rotenone was obtained by subtracting the rotenone actually present in a given sample from the percentage "rotenone" based on toxicity to house-flies [*i.e.*, the concentration of rotenone necessary to kill 50 per cent. expressed as a percentage of the concentration of the given sample necessary to produce the same result under the same conditions]. If this figure be divided by the percentage of total extractives minus the percentage of rotenone, a factor is obtained that expresses the relative toxicity of the other extractives in terms of rotenone.

This factor was worked out for each of the 6 samples of derris root with all 3 extractants and the average was found to be 0·5 for carbon tetrachloride and benzene and 0·4 for acetone extracts. The average factor for the 5 samples of cubé root was 0·4 for all 3 extractants. These average factors were used to calculate the toxicity of the samples (by adding the percentage of rotenone to the percentage of other extractives multiplied by the factor). When the results were compared with the toxicity obtained in the tests with house-flies, the agreement was almost as good as when the values for rotenone based on "rotenone equivalent to methoxyl" minus "alkali soluble" material were used for comparison. The factors may change somewhat as improvements are made in the methods of determining rotenone and total extractives and as further insecticidal work is done, but it is believed that such calculations based on an approximately constant toxic value for the extractives other than rotenone are possible and that the factors to be used will not change greatly. The values given are derived from work on house-flies and may not hold good for toxicity to any other insect, unless it can be shown that the ratio of the toxicity of rotenone to that of the other extractives is the same for the other species of insect.

Weidner (H.). **Beiträge zu einer Monographie der Raupen mit Gifthaaren.** [Contributions to a Monograph on Lepidopterous Larvae with urticating Hairs.]—*Z. angew. Ent.* **23** no. 3 pp. 432–484, 10 figs., 18 pp. refs. Berlin, September 1936.

This paper comprises a review of the extensive and widely scattered literature on the Lepidopterous larvae that have urticating hairs and an account of the toxic action of these hairs. Confusion has arisen in the literature owing to failure to realise that the larvae are of two entirely different types. In one type (Notodontids, Lymantriids and Lasiocampids), the toxic action depends on small hairs, scarcely 1 mm. long. To this group belong also hairy caterpillars only occasionally reported as urticating, such as Arctiids and some Noctuids. Larvae of the second type, which are nearly all tropical or subtropical species

and include Saturniids, Megalopygids and Limacodids, have poisonous spines; in their final instar many of them have also hairs like those of the the first type.

Lieftinck (M. A.). **Over** *Haematomyzus elephantis* **Piaget.**—*Ent. Med. Ned.-Ind.* **2** no. 3 pp. 34–35, 1 fig. Buitenzorg, 1st September 1936.

A brief note is given on the characters and systematic position of *Haemotomyzus elephantis*, Piaget, which was found infesting a young elephant in the Netherlands Indies.

van Volkenberg (H. L.). **Animal Parasitology.**—*Rep. P. R. Exp. Sta. 1935* pp. 23–26. Washington, D.C., July 1936.

This paper includes comparative lists of the species of lice and mites that infest domestic animals and poultry in Porto Rico and the United States, showing their hosts. So far, only the chronic form of piroplasmosis of dogs has been found in Porto Rico, and *Rhipicephalus sanguineus*, Latr., which is widely distributed, is probably the only vector there.

Ford (N.). **Further Observations on the Behaviour of** *Wohlfahrtia vigil* **(Walk.) with Notes on the Collecting and Rearing of the Flies.**—*J. Parasit.* **22** no. 4 pp. 309–328, 4 figs., 1 map, 26 refs. Baltimore, Md, August 1936.

Descriptions are given of 4 cases of myiasis in infants that occurred in Toronto in June 1934, all of which were caused by the larvae of *Wohlfahrtia vigil*, Wlk. [*cf. R.A.E.*, B **21** 70]. The children had all been sleeping out of doors, a fact that emphasises the importance of keeping babies carefully screened when in the open. During 1933–35, collections of adults of this fly were made in the field. It was observed that they were frequently taken on railway tracks or near water, and it was also found that the infants affected with myiasis all lived within short distances of railways. In laboratory experiments in a multiple temperature incubator, a fly settled for the night at the warmer end at a point registering 28°C. [82·4°F.]; in the morning, when the temperatures had risen, the fly was resting at 33°C. [91·4°F.] and eggs had been laid on meat at a temperature between 27 and 29°C. [80·6 and 84·2°F.]. On cool days in September, when room temperature was about 22°C. [71·6°F.], deposition of eggs or larvae was induced by placing the flies at higher temperatures. It is suggested that the warmth of the railway lines exerts a definite attraction that accounts for the presence of the flies in their vicinity. From the fact that females were taken early in the day and in the evening (after the males have become dormant) it would appear that they avoid bright sunshine. The males are definitely heliotropic. The behaviour of the females when depositing larvae on laboratory animals is described. Observations on the development of the larvae in laboratory animals and in a multiple temperature incubator suggest that the rate of growth is accelerated by the body temperature of the host. The technique used in rearing the flies is described. During the summer of 1934, larviposition took place 13–17 days after emergence, and the flies lived for 30–40 days. The larval period lasted 7–9 days, and the pupal period 10–12.

SMITH (L. W.) & HUSSAIN (Mumtaz). **A cheap Blowfly Trap.**—*Agric. Live-Stk India* **6** pt. 4 pp. 504–505, 1 pl. Delhi, 1936.

A description is given of a cheap and effective trap for blowflies that differs only slightly in construction from one already noticed [*cf. R.A.E.*, B **22** 23].

MACKERRAS (I. M.), FULLER (M. E.), AUSTIN (K. M.) & LEFROY (E. H. B.). **Sheep Blowfly Investigations. The Effect of Trapping on the Incidence of Strike in Sheep.**—*J. Coun. sci. industr. Res. Aust.* **9** no. 3 pp. 153–162, 2 figs., 3 refs. Melbourne, August 1936.

A detailed account is given of experiments carried out on two sheep farms, in New South Wales and Western Australia respectively, in 1932, 1933 and 1934 to determine whether trapping blowflies in the field reduces infestation of sheep by them. The traps used were of the two types described in a paper already noticed [*R.A.E.*, B **21** 118]; the number varied from 1 to 100 acres to 1 to 18, but in 2 or 3 cases extra traps were placed around the trapped areas. On the average the incidence of strike in trapped areas was half that in the control areas. As care had been taken that the sheep in the different areas were equally susceptible and that conditions were similar, the reduction in strike incidence would appear to have been due to trapping.

SMITH (G. Pugh). **The Growth Stimulation of Blowfly Larvae fed on fatigued Frog Muscle. ii.**—*J. exp. Biol.* **13** no. 3 pp. 249–252, 2 refs. London, July 1936.

In further investigations on the larvae of *Calliphora erythrocephala*, Mg., fed on fatigued frog muscle [*cf. R.A.E.*, B **21** 120], it was found that heat destroyed the growth-stimulating property of fatigued muscle, and that the blood of frogs of which the muscles had been artificially fatigued also acted as a growth stimulant. Experiments to determine whether this growth stimulant accumulated in the liver gave negative results. During each period of 24 hours that the larvae remained on their successive meals of muscle, bacteria grew on the muscle. It is therefore conceivable that these bacteria are responsible for the differential growth of the larvae. Counts showed no significant difference in the population densities of bacteria on fatigued and non-fatigued muscle after the larvae had lived on them, but it remains to be studied whether the bacteria on fatigued muscle are different in kind.

MACLEOD (J.). **A new Blowfly attacking Sheep in Western Scotland.**—*Nature* **138** no. 3489 pp. 467–468, 3 refs. London, 12th September 1936.

In the course of an investigation on blowflies attacking sheep in Britain, 13 batches of larvae taken from cases of strike in the field in Mull and Western Argyllshire were reared to the adult stage in the laboratory and 7 of them were found to consist exclusively of *Phormia terraenovae*, R.-D. The batches were all obtained from black-faced sheep in long wool, and the strikes had occurred on various parts of the body, including the throat, loins and breech. The individual batches yielded from about a dozen to more than 300 flies. It would thus appear that, in western Scotland at least, this species acts as a

primary blowfly, causing strike on areas where the wool is relatively clean. It has not been recorded previously from any country as attacking sheep, and in view of its wide distribution in Europe and North America, the absence of such records is of interest.

LOEWENTHAL (L. J. A.). **A Note on Tick-typhus in the Eastern Province of Uganda.**—*E. Afr. med. J.* **13** no. 5 pp. 141–145, 10 refs. Nairobi, August 1936.

The author describes from the Eastern Province of Uganda three cases of typhus apparently identical with the tick-borne variety observed in Kenya [*cf. R.A.E.*, B **23** 262]. An initial ulcer was present in all, but in only one was a tick removed from the site.

CARPANO (M.). *Trypanosoma* **observed in a Bird of the Genus** *Pyrrhula* (*Trypanosoma faridi*).—*Bull. Minist. Agric. Egypt* no. 165, 5 pp., 3 pls., 1 fig., 6 refs. Cairo, 1936.

A description is given of *Trypanosoma faridi*, sp. n., isolated in Cairo from the heart blood and pulmonary tissues of a bullfinch (*Pyrrhula*) that had died. This bird had been kept isolated since its arrival from Berlin less than a month previously. As it was infested with mites of the genus *Dermanyssus*, it is suggested that these parasites may be responsible for the transmission of the trypanosome.

ELTRINGHAM (H.). **On the Eyes of Tsetse Flies.**—*Trans. R. ent. Soc. Lond.* **85** pt. 11 pp. 281–285, 1 pl. London, 31st August 1936.

A description is given of the eyes of tsetse-flies (*Glossina*). The structure in the different species examined did not vary greatly either in the species or the sexes. The cornea has a much flatter curve in the front of the eye than at the sides, and it may well be that the anterior facets can see for a greater distance than the lateral ones. If this be so, it would seem that the eye is well adapted, so far as a compound eye can be, to distinguish distant objects, though it is true that other flies that appear to depend less on sight than on scent have similar eyes.

BOUVIER (G.). **Quelques hyménoptères ennemis des glossines.**—*Ann. Paras. hum. comp.* **14** no. 4 pp. 330–331. Paris, 1936.

The author records the collection of 7 males and 8 females of *Glossina palpalis*, R.-D., from 8 out of 17 burrows of Sphegids in a bare, sandy, unshaded spot a short distance from a forest clearing near Luputa in the Belgian Congo. The species in the burrows of which the flies were found were *Sphex xanthocerus*, Ill., *S. umbrosus*, Christ, and *Synagris proserpina nyassae*, Stadelman. A colony of *Bembex braunsi*, Handl., was found in which the nests were only an inch or so apart ; in one nest, among numerous other Diptera, were a male and a female of *G. palpalis*.

HARTZELL (A.) & WILCOXON (F.). **Relative Toxicity of Pyrethrins I and II to Insects.**—*Contr. Boyce Thompson Inst.* **8** no. 3 pp. 183–188, 1 fig., 15 refs. Yonkers, N.Y., 1936.

An account is given of experiments on *Aphis rumicis*, L., and house-flies (*Musca domestica*, L.), made to ascertain whether discrepancies in the findings of various investigators as to the comparative

toxicity to insects of pyrethrins I and II might be due either to different susceptibilities in the insects used or difference in the physical state of the pyrethrins at the moment of application. A partial separation of pyrethrins I and II was effected by multiple extraction, using as solvents petroleum ether and aqueous acetic acid. Extracts were obtained in which the ratio of I to II varied from 4 to 0·047 according to the Seil method of analysis. To determine their toxicity to *A. rumicis*, acetone and a miscible oil were used as solvents for the pyrethrins with water. When acetone was used, extracts high in pyrethrin I were considerably more toxic than extracts high in pyrethrin II, but when a miscible oil was used, the difference in toxicity tended to disappear.

When similar extracts were tested on house-flies by means of the Peet-Grady method [*cf. R.A.E.*, B **16** 255], using a kerosene carrier, the differences in toxicity of extracts high in pyrethrin I and extracts high in pyrethrin II were not statistically significant. Similar results were given by a modified Nelson method, in which adult house-flies four to seven days old were chilled for 30 minutes at –6°C. [21·2°F.], until they became quiescent, and were then removed to a cold room at 3°C. [37·4°F.]. The solution (in ethyl alcohol) was applied from a micropipette delivering a drop of 0·75 cu. mm. The flies were lifted by the wing so that the ventral surface of the thorax touched the issuing drop. After treatment, they were removed to room temperature in a 400 cc. beaker, which was placed in a 2 litre beaker containing a wad saturated with milk. The latter was covered with muslin, and counts of living and dead flies were made after 24 hours. About 50 flies were used in each test, and the counting was facilitated by the separation of living flies feeding on the milk.

The results indicate that even when the same insect is used the ratio of toxicity depends on the method of application. In kerosene the pyrethrins are in solution, whereas in aqueous sprays made by pouring acetone solutions of the pyrethrins into water they are thrown out of solution, forming emulsions of varying stability, so that it further appears that the physical condition of the toxic agent is a determining factor.

AHMAD (T.). **The Influence of constant and alternating Temperature on the Development of certain Stages of Insects.**—*Proc. nat. Inst. Sci. India* **2** no. 2 pp. 67–91, 7 graphs, 11 refs. Calcutta, 5th August 1936.

A detailed account is given of experiments on the influence of both constant and fluctuating temperatures on the rate of development of the eggs of a locust [*R.A.E.*, A **25** 43] and on the pupae of *Calliphora erythrocephala*, Mg., and *Muscina stabulans*, Fall. The method of rearing and handling the pupae is briefly described.

The length of the pupal period and the percentage mortality of the pupae of *C. erythrocephala* were determined at 6 constant temperatures (10·5, 14·8, 18·4, 23, 27 and 30°C. [50·9, 58·64, 65·12, 73·4, 80·6 and 86°F.]) and for 4 different saturation deficiencies (3, 9, 14 and 21 mm.). The length of the pupal period depended mainly on temperature and only to a very small extent on saturation deficiency. At all temperatures, the duration of the pupal period and the percentage mortality were at a minimum with a saturation deficiency of 9 mm. At this humidity, the mean pupal period ranged from 48·58 days at

10·5 to 7·8 at 30°C. Saturation deficiencies above as well as below this slightly lengthened the pupal period but produced a marked increase in mortality. Under favourable conditions of moisture and temperature, more than 90 per cent. of the pupae completed their development, 94·9 per cent. being viable at 9 mm. and 18·4°C. Temperatures higher than the optimum seemed to be more injurious than those below it. In the second series of experiments, the pupae were exposed to a low temperature of 5°C. [41°F.] for 1, 4 or 8 days at different stages in the first half of their development and kept for the remainder of the period at constant temperatures ranging from 14·8 to 30°C. In all experiments, there was significant acceleration of development at temperatures of 14·8, 18·4 and 23°C., the acceleration increasing with the length of exposure to the low temperature. At the higher temperatures of 27 and 30°C. no acceleration occurred. The stage of development at which the pupae were exposed to the low temperature had no significant effect on the rate of acceleration. The viability of the pupae was, on the whole, not appreciably affected by the period of exposure to cold. When a low temperature of 0°C. [32°F.] was used instead of 5°C., a slight acceleration took place at 14·8 but none at 18·4 or 23°C. In the third series, the pupae were subjected daily to about 8 hours at 0 or 5°C. and 16 at 18·4, 23 and 27°C. When the low temperature was 0°C. the rate of development was not affected, but when it was 5°C. there was a marked acceleration at the two lower temperatures and a very slight one at 27°C.

In similar experiments with *M. stabulans*, the minimum duration of the pupal period and the maximum viability were obtained with a saturation deficiency of 3 mm. at all temperatures used. The mean pupal period at this humidity ranged from 23·04 days at 14·8°C. to 5·99 at 32°C. [89·6°F.]. When pupae were exposed for 1–8 days to a low temperature of 5°C., a certain amount of acceleration in their rate of development was observed when the high temperature was 18·4 or 23°C. (although this was not nearly so marked as in the case of *C. erythrocephala*), but none when it was 30°C. Prolongation of exposure to the low temperature increased mortality. The injury caused by low temperature was greater among freshly formed pupae than among those that had undergone some development. When the low temperature was 0°C., the rate of development at constant and alternating temperatures was about the same ; the adverse effect on viability was similar to that exerted by exposure to 5°C. When the pupae were kept for 8 hours daily at 5°C. and 16 hours at 18·4, 23 or 30°C., development was more rapid than at constant temperatures or after a single period of exposure to a low temperature. When the low temperature was 0 instead of 5°C., no measurable acceleration took place.

C. erythrocephala is adapted to a cold habitat and has a theoretical threshold of development at about 6°C. [42·8°F.]. It is exposed to long spells of cold in nature, and alternating temperatures in which the low temperature is below the threshold of development may occur in its natural environment. In the present experiments, alternating temperatures accelerated development without affecting viability, provided that the low temperature was not so low as to be injurious. It is possible that a certain amount of development took place at 5°C., since this is only just below the threshold of development, but the acceleration observed was greater than could have been accounted for by this alone and must have been due in part at least to the fluctuations

of temperature employed. The larval and pupal stages of *M. stabulans* have been observed in a variety of environments. In the experiments, no notable acceleration in development was brought about by alternating temperatures and viability was affected by long exposure to cold.

These studies indicate that alternating temperatures affect different insects in different ways, probably depending on the environment to which the insect is adapted in nature.

MARTINI (E.). **Wege der Seuchen.** [The Ways in which Epidemics Spread.]—Roy. 8vo, vi + 109 pp. Stuttgart, Enke, 1936. Price, paper, *M*.4·50. (Germany and Palestine *M*.6.)

The subject of this work is a consideration of the factors concerned in the production of epidemics of diseases of man that require the agency of vectors or intermediate hosts. The rôle of intermediate hosts and of monophagous and polyphagous vectors and the influence on them of civilisation, soil conditions and climate are reviewed. The co-operation and inter-relation of these three influences are considered and attention is drawn to the fact that progress in medical entomology now permits to a certain extent the prediction of the annual course of epidemics of some diseases, such as malaria.

In appendices the author illustrates the manner in which mathematics may be applied to epidemiology. Taking the example of malaria, he discusses the mathematical representation of the potential spread of infection, the dependence of the number of new infections on variations in the number of cattle in a given locality, the potential increase of Anophelines under given conditions, the application to them of the method of graphic representation of the dependence of the rate of development of insects on temperature, and long-period calculations of the course of malaria in a given society.

ELIOT (C. P.). **The Insect Vector for the Natural Transmission of *Eperythrozoon coccoides* in Mice.**—*Science* **84** no. 2183 p. 397, 7 refs. New York, 30th October 1936.

In each of eleven experiments with *Polyplax serrata*, Burm., the adults and nymphs transmitted *Eperythrozoon coccoides* to healthy mice by feeding on them, the organisms appearing in the blood in 9–17 days. In other tests, in which lice from the same infected host were starved for several hours before being fed on the healthy mice, the adults did not transmit the disease, whereas the nymphs did. These results suggest that owing to their stronger digestive fluids, the organism cannot survive so long in the adults as in the nymphs. The two mites tested, *Myobia musculi*, Claparède, and *Myocoptes musculinus*, Koch, failed to transmit the organism.

CHAGAS (E.). **Visceral Leishmaniasis in Brazil.**—*Science* **84** no. 2183 pp. 397–398. New York, 30th October 1936.

In 1936 the author investigated a disease that was found to be caused by Leishman bodies morphologically identical with those of *Leishmania donovani* and to be clinically very similar to kala-azar. Scattered cases have been recorded from most of the northern and eastern States of Brazil and the Argentine Chaco, but no epidemic has been found in any focus. No case has been seen in towns, and investigation has shown the existence of jungle infection as a rule. Species of *Phlebotomus* have been found regularly in every focus.

Papers noticed by Title only.

Le Pelley (R. H.) & Sullivan (W. N.). **Toxicity of Rotenone and Pyrethrins, alone and in Combination.**—*J. econ. Ent.* **29** no. 4 pp. 791–797, 3 figs., 7 refs. Menasha, Wis., August 1936. [See *R.A.E.*, A **25** 34.]

Fink (D. E.) & Vivian (D. L.). **Toxicity of Certain Azo Compounds to Mosquito Larvae.**—*J. econ. Ent.* **29** no. 4 p. 804. Menasha, Wis., August 1936. [See *R.A.E.*, A **25** 35].

Fink (D. E.) & Smith (L. E.). **Toxicity of Certain Organic Compounds to Culicine Mosquito Larvae.**—*J. econ. Ent.* **29** no. 4 pp. 804–805. Menasha, Wis., August 1936. [See *R.A.E.*, A **25** 36.]

May (R. M.). **L'hexachloréthane dans la lutte contre les moustiques.**—*Ann. Inst. Pasteur* **57** no. 3 pp. 325–336, 2 figs., 1 ref. Paris, September 1936. [*Cf. R.A.E.*, B **24** 128.]

Morishita (K.). **On the Species of the Formosan Anophelines.** [*In Japanese.*]—*Zool. Mag.* **48** no. 8–10 pp. 537–579. Tokyo, October 1936. [*Cf. R.A.E.*, B **24** 254, 255, 314, etc.]

De Meillon (B.). **The Systematic Position of** *Anopheles listeri* **De Meillon.**—*Publ. S. Afr. Inst. med. Res.* no. 38 pp. 129–130, 2 figs., 3 refs. Johannesburg, April 1936.

De Meillon (B.). **The Eggs of some South African Anophelines. Part II.** [*Anopheles coustani*, Lav.. and var. *tenebrosus*, Dön.]—*Publ. S. Afr. Inst. med. Res.* no. 38 pp. 131–132, 4 figs., 1 ref. Johannesburg, April 1936. [*Cf. R.A.E.*, B **22** 211.]

De Meillon (B.). **South African Ceratopogonidae. Part I. The Species recorded from South Africa** [including South-West Africa, Portuguese East Africa and Northern and Southern Rhodesia].—*Publ. S. Afr. Inst. med. Res.* no. 38 pp. 136–140. Johannesburg, April 1936. **Part II. Some New and unrecorded Species** [including 22 new species from South Africa and 1 from South-West Africa].—*T.c.* pp. 141–207, 28 pls., many refs.

Bouvier (L.). **Trois Tabanides nouveaux du Congo Belge.**—*Rev. Zool. Bot. afr.* **28** fasc. 4 pp. 510–512. Brussels, 18th September 1936.

Barber (M. A.). **A Survey of Malaria in Cyprus.**—*Annu. med. sanit. Rep. Cyprus 1935* pp. 62–69, 5 refs. Nicosia, 1936. [*See R.A.E.*, B **24** 267.]

Coatney (G. R.) & Roudabush (R. L.). **A Catalog and Host-index of the Genus** *Plasmodium.*—*J. Parasit.* **22** no. 4 pp. 338–353. Baltimore, Md., August 1936.

Wagner (J.). **Flöhe, Aphaniptera (Siphonaptera, Suctoria).** [Keys to the Genera and Species of Fleas of Central Europe.]—*Tierwelt Mitteleur.* **6** 3. Teil, 2. Lief., xvii, 24 pp., 84 figs., many refs. Leipzig, 1936.

Collins (P. B.). **Household Pests. Their Habits, Prevention and Control.** [A popular account dealing with pests occurring in Britain.]—Crown 8vo, 98 pp., 6 figs. London, Sir I. Pitman & Sons, Ltd., 1936. Price 2*s*. 6*d*.

Lamborn (W. A.) & Howat (C. H.). **A possible Reservoir Host of** *Trypanosoma rhodesiense*.—*Brit. med. J.* no. 3935 pp. 1153–1155, 1 graph, 2 refs. London, 6th June 1936. [Recd. November 1936.]

Some workers maintain that *Trypanosoma rhodesiense* is distinct from *T. brucei* and specific to man [*cf. R.A.E.*, B **17** 39], whereas others consider that the former is merely a variant of the latter that, for reasons imperfectly understood, has become pathogenic to man. If the first supposition is correct, man must be the reservoir of *T. rhodesiense*. The authors describe a case in Nyasaland in which polymorphic trypanosomes were found in the blood of a patient who, although he has been under observation for six months, has shown no sign or symptom of trypanosomiasis, except two slight and transient rises in temperature and a positive formol-gel reaction tested against a control. Weekly examination of his blood showed that the parasite rate varied widely from week to week without apparent cause, although it rose with the two rises in temperature. The trypanosomes were identified as *T. rhodesiense* by their pathogenicity to rats and by the development of posterior nuclear forms in these animals. Two dogs subinoculated hypodermically from the patient showed trypanosomes in the peripheral blood 8 and 15 days later, respectively, and both died on the 31st day. Infection was also transmitted directly by an example of *Musca sorbens*, Wied., which fed on the blood of the patient and was then transferred to an incision on the ear of a dog ; trypanosomes were seen 35 days later and the dog died on the 48th day. Cyclical development took place in a bred example of *Glossina morsitans*, Westw., that had fed on the patient 2 days after its emergence ; metacyclic forms were seen in large numbers in the salivary glands on the 20th day. A fly in which cyclical development had taken place after it had fed on a dog subinoculated from the patient, transmitted a fatal infection to a rat, in which parasites were seen for the first time on the 44th day.

Thus the virulence of the parasites is obvious and the patient is either passing through a latent stage in the course of active trypanosomiasis (which appears unlikely in the case of infection with *T. rhodesiense*), or he is a carrier. Although the area from which he came is infested with *G. morsitans*, an extensive search has failed to reveal any cases of sleeping sickness. Notes are given on two epidemics, one in Nyasaland and one in Tanganyika Territory, that began in 1908 and 1910 and appear to be traceable to single human carriers. The authors conclude that this case may indicate that *T. brucei*, occurring in areas where human trypanosomiasis is not known, can infect man. Its importance lies in the fact that the spread of sleeping sickness is, in all probability, mainly due to the movements of human carriers of a strain of trypanosome that is not immediately pathogenic to man but may become so after more than one passage through man.

Lamborn (W. A.). **Annual Report of the Medical Entomologist for 1935.**—*Annu. med. Rep. Nyasaland 1935* pp. 50–52. Zomba, 1936.

Notes are given on the observations and experiments described in detail in the preceding paper.

Further work on the transmission of *Bacillus leprae* by *Musca sorbens*, Wied. [*cf. R.A.E.*, B **24** 187] was carried out to determine why certain flies deposited bacilli freely on food material shortly after

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their infecting feed, whereas others failed to do so, and also why bacilli were deposited at certain feeds but not at others taken in the intervals between them. It was found that the deposition of bacilli is determined by the acts of regurgitation that take place in the course of transferring the food material from the crop to the stomach. At each of these acts the proboscis may become contaminated with whatever organisms the food material has contained ; between these acts the flies feed, for their appetites are almost insatiable. The correctness of this conclusion was demonstrated by allowing females to feed individually on drops of blood on a slide at various periods after their feed on leprous material and shortly after regurgitation ; large numbers of the drops showed bacilli. When a leper who had numerous open sores came to the laboratory, he brought an umber of flies that were feeding on them, and partly engorged flies in which bacilli were found were actually collected on native assistants. Whether infection can be produced in this way would seem to depend on whether the viability of the organisms is impaired by contact with the secretions of the upper part of the alimentary tract of the insects. Flies fed on the serous exudate from a yaw, in which *Spirochaeta* (*Treponema*) *pertenuis* was abundant, and subsequently allowed to feed at a scratch on a native volunteer transmitted the infection. One primary and five secondary yaws appeared on the site and spirochaetes were found in abundance in one of the latter examined 76 days after the flies had fed. To determine whether cyclical development occurred, dissections of 42 flies were made at intervals of 2–25 days after feeding on a yaw known to contain spirochaetes, but the results were negative.

A chance examination of the excreta of *Glossina morsitans*, Westw., revealed the presence of large numbers of flagellated organisms, and it was suggested that these might be forms of *Trypanosoma grayi*, which has not yet been found in flies of the *morsitans* group. To obtain data on the incidence of these organisms in nature, a series of captured flies was maintained over as long a period as possible and their excreta examined. Out of 169 flies, 29 passed the organisms at some period. In the excreta of one fly, they occurred on the 17th, 19th, 20th, 29th, 32nd, 34th, 35th and 39th day after its capture, and when it was dissected on the 39th day enormous numbers were found at and below the proventriculus, a fact that supports the hypothesis that they are developmental forms of *T. grayi*.

From tsetse-fly surveys in the Northern Province in May and October, it was concluded that the position remains satisfactory [*cf.* **24** 186].

Yamada (S.), Asada (J.) & Miyada (I.). **Studies on the Life-history of a Common Rat-tapeworm,** *Hymenolepis diminuta* **(Rudolphi), especially on the Relation between this Tapeworm and Rat-Fleas.** [*In Japanese.*]—*Zool. Mag.* **48** no. 8–10 pp. 437–464, 3 pls., 6 refs. Tokyo, October 1936. (With a Summary in English.)

An account is given of experiments showing that the rat fleas, *Ceratophyllus anisus*, Roths., *C. fasciatus*, Bosc, *Leptopsylla segnis*, Schönh. (*musculi*, Dugès), and *Xenopsylla cheopis*, Roths., are intermediate hosts of *Hymenolepis diminuta*, which infests house-rats and often man in Japan. Eggs of the tapeworm were mixed with the food given to the larvae of the fleas, and the development of the oncospheres

and cysticercoids in the larvae was observed. The numbers of larvae exposed to infection were 75 of *C. anisus*, 621 of *C. fasciatus*, 316 of *L. segnis* and 673 of *X. cheopis*. The numbers and (in brackets) percentages infected were 23 (30·66), 172 (27·69), 88 (27·85) and 4 (0·59), respectively. The number of oncospheres or cysticercoids found in one larva varied from 1 to 20 or more. Investigations to determine the natural ratio of infection of adult fleas found on living rats showed that 6 (2·11 per cent.) were infected among 284 of *C. anisus*, 11 (1·22 per cent.) among 905 of *C. fasciatus*, 1 (0·82 per cent.) among 122 of *L. segnis* and none among 98 of *X. cheopis*. The authors also successfully infected rats by feeding them on fleas that contained cysticercoids and had developed from larvae fed on the eggs.

KAWAMURA (R.) & IKEDA (K.). **Ecological Study of the Tsutsugamushi,** *Trombicula akamushi* **(Brumpt).** [*In Japanese.*]—*Zool. Mag.* **48** no. 8–10 pp. 553–563, 3 figs., 4 refs. Tokyo, October 1936. (With a Summary in English.)

The larvae of *Trombicula akamushi*, Brumpt, which occur in the conchae of the field vole, *Microtus montebelli*, in districts of Japan where tsutsugamushi disease is endemic, are classified into several forms, based on morphological characters. The form with fine bristles and that with stout bristles are the ones most commonly found. The former has been generally believed to be the vector of the disease, since it has been found only in the summer, when the disease is prevalent, while the latter has been collected all the year round. In the investigation here described, however, the authors found that both forms occur throughout the year and that there is no seasonal difference between them.

The prosopon of the mite lives in the superficial layers of the soil, generally near the surface in the warm season and further down as the temperature falls, though when the ground is thickly covered with snow it comes up again close to the surface. Mature eggs (1–8 in number) are found in the body of the prosopon in May–September, and the larvae emerge during the same months. If they succeed in attacking the field voles in summer, they undergo a series of stages of development in the ground ; the prosopon stage is reached in autumn, and eggs are laid in the following year. If, however, the larvae attack the host during the cold season, they develop into nymphochrysalids as usual, but their further development is not completed until late in the following spring, when they become active and pass through the subsequent stages. If the larvae do not find a host, they may live and retain their power to feed for nearly a year. The fact that cases of tsutsugamushi disease in man never occur in the cold season is not due, therefore, to the absence of larvae but to the physical environment of the districts where the disease is endemic.

OHMORI (N.). **Studies of the Tropical Rat Mite. Second Report—On the Sex Ratio and Parthenogenesis.** [*In Japanese.*]—*Zool. Mag.* **48** no. 8–10 pp. 627–637, 1 graph, 6 refs. Tokyo, October 1936. (With a Summary in English.)

This is an account of further work [*cf. R.A.E.*, B **24** 60], carried out at Taihoku, Formosa, from December 1935 to May 1936, on the bionomics of the tropical rat mite [*Liponyssus nagayoi*, Yamada]. Of the

eggs of fertilised females, 30–79 per cent. of those laid during the first two-thirds of the oviposition period yielded females, but those laid during the last third yielded males only. Both fertilised and unfertilised females began to oviposit about 3 days after a full blood-meal. Eggs of unfertilised females produced males only. There was no significant difference in the duration of the stages of development between the offspring of fertilised and unfertilised females.

GUIMARÃES (L. R.). **Nota sobre a destruição de pulgas por meio de insecticidas.** [A Note on the Destruction of Fleas by Means of Insecticides.]—*S. Paulo Medico* Ann. **9** vol. **1** no. 6 pp. 473–482, 10 refs. S. Paulo, June 1936. [Recd. October 1936.]

Various methods of destroying fleas are briefly reviewed, and an account is given of tests of insecticides on *Xenopsylla cheopis*, Roths., *X. brasiliensis*, Baker, and *Leptopsylla segnis*, Schönh., in São Paulo. Experiments on a small scale showed the most effective formula to be 2 parts Flit, 2 parts kerosene, 1 part creolin and 20 parts water. This was then tested by placing infested rats in a cage in a room where the insecticide was atomised at the rate of 1·09 fl. oz. per 1,000 cu. ft. space. On the following day, 76 dead fleas were counted and 212 live ones, the mortality being 26·38 per cent. In two subsequent tests, mortalities of 75 and 72 per cent. were obtained by applying the spray at the rate of 3·63 fl. oz. per 1,000 cu. ft.

MAZZA (S.) & others. **Enfermedad de Chagas.**—*9. Reun. Soc. argent. Pat. reg., Mendoza 1935* **1** pp. 1–568, illus., refs. Buenos Aires, 1936.

Dedicated to the late Carlos Chagas, this volume includes a number of papers by various authors dealing with Chagas' disease in man and animals in Argentina. *Triatoma platensis*, Neiva and *Eutriatoma sordida*, Stål, are recorded from the province of Santa Fé, no flagellates of *Trypanosoma* (*Schizotrypanum*) *cruzi* being found in them [*cf. R.A.E.*, B **24** 137]. *Eutriatoma oswaldoi*, Neiva & Pinto, and *Triatoma infestans*, Klug, were found naturally infected with *T. cruzi* in north-eastern Argentina. In the province of La Rioja infection was found in 75 per cent. of *T. infestans*. Of 1,557 individuals of this species collected in 500 houses in the province of Mendoza, 147 (9·44 per cent.) were infected, namely 120 adults, 26 nymphs, and 1 larva. In another series of over 1,000, infection was found in 14 per cent.

MAZZA (S.). **Investigaciones sobre la enfermedad de Chagas. Comprobaciones de casos agudos de enfermedad de Chagas en nuevas partes de la zona biológica chaqueña (Formosa, Chaco Salteño). Hallazgos epidemiológicos especiales de la región.**—*Publ. Misión Estud. Pat. reg. argent. Jujuy* no. 27, 48 pp., 38 figs., 20 refs. Buenos Aires, 1936.

Cases of Chagas' disease in man are recorded from new localities in the Chaco region of Argentina. *Trypanosoma* (*Schizotrypanum*) *cruzi* also occurred in cats, birds and opossums, and in *Tolypeutes*

matacos, which last is the fifth armadillo found to harbour it in Argentina, the others being *Chaetophractus vellerosus*, *C. v. pannosus*, *Dasypus novemcinctus* and *Zaedyus pichiy caurinus*. *Triatoma infestans*, Klug, was strongly infected. In the nests of birds it was sometimes associated with *Psammolestes coreodes*, Bergroth, which is described [*cf. R.A.E.*, B **24** 38].

BABCOCK (O. G.) & BLACK (W. L.). **The Common Sheep-scab Mite and its Control.**—*Bull. Texas agric. Exp. Sta.* no. 479, 34 pp., 7 figs., 17 refs. College Station, Tex., October 1933. [Recd. October 1936.]

Psoroptes ovis, Hering, is an important parasite of sheep in Texas, as well as in many other parts of the United States, and an investigation of its bionomics and control has been carried out since 1924 [*cf. R.A.E.*, B **14** 100; **16** 263]. Efforts have been made to eradicate it, and in 1932 not a single case was reported in Texas. It attacks practically any part of the body and causes large quantities of wool to be shed, pulled or rubbed off, until in some cases, the animal is entirely bare. A key is given to distinguish it from other mange mites infesting sheep, and its life-history is reviewed from the literature [*cf.* **1** 81; **4** 184; etc.]. Fifteen tests were made to determine whether goats would become infested with *P. ovis* or whether they would transmit it mechanically from infested to uninfested sheep, but all results were negative. Observations extending over more than two years on an artificially infested sheep confirm the view that there are periods when the mites are inactive. As there were leaks in the roof of the shed, the animal was partly soaked whenever it rained; the sudden outbreaks of mange that followed each rainy spell indicate a relationship between moisture and oviposition. In sheep artificially infested with scabs containing eggs or with a definite number of living female mites, mange developed in 12–51 days. When uninfested sheep were placed in contact with infested ones, symptoms appeared in 54–154 days. In one of these experiments, in which no signs of mange were seen for 154 days, new wool grew over the bare areas on the originally infested sheep and no mites could be found; this corroborates the many field observations that mites may be present in a flock for a long time before the animals reveal signs of infestation. Individual animals differ greatly in the severity of their reactions to infestation, though the different breeds tested appear to be equally susceptible.

To ascertain the longevity of the mites apart from their hosts, known numbers were placed under different conditions and examined daily until they died. In the insectary, where the temperature was 70–80°F., the containers were in the shade and the mites in them in the dark. Out of 640 mites, only one survived more than 21 days, the average longevity in 51 tests being 12 days 6 hours. As it is commonly believed that sheep may become infested by visiting caves in which infested sheep have died, mites in tags of wool in pill boxes were placed in different positions in a cave; they lived for 8–19½ days. The temperature in several caves in Texas ranged between 70 and 72°F. and the humidity between 95 and 97 per cent. throughout the year. Mites were also kept in the open more or less exposed to the sun under conditions simulating those in infested sheep pens. Exposures of 1–3 hours to temperatures of about 113–120°F. were often necessary to destroy

them. Mites in a tag of wool fastened to a wire fence 3½ ft. above the ground avoided the sun so far as possible and survived 5 days and longer following an exposure of 15 minutes. It is probable that under favourable conditions the mites are not influenced by environment but die from lack of food.

In 37 tests carried out over a period of 5 years, healthy sheep were introduced immediately or after an interval of 1–120 days into pens from which infested sheep had been removed. In the first series the fleece sheared from one of the infested animals was left under the shed in the pen, and in the second series it was left under the shed in a bag and, when the clean sheep were introduced, it was divided and tied on the backs of two of them. Infestation took place in only 4 cases, 1 in each series when the healthy sheep were introduced immediately and 2 in the second when they were introduced after 6 and 10 days respectively. When adult mites were placed in containers with wool, young mites appeared at intervals for up to 15 days, though in most cases they did not live more than 2 days. Thus fertile eggs may be deposited off the host, and young mites might infest a clean sheep if they gained access to it not later than 17 days after the removal of the parent mite.

Experiments were carried out over a number of years to test the value of various dips for the control of the mite. It was found that the standard dips, lime-sulphur testing 0·18–0·19 per cent. polysulphides and nicotine sulphate testing 0·07 per cent. nicotine, are satisfactory; with both it is important that the temperature of the dip should be 103–110°F., the higher temperatures being used in summer. Two dippings of 3 minutes each at an interval of 10 days should eradicate the mite if care is taken that all parts of the animal, including the head, are thoroughly wetted. Several other dips showed promise, particularly finely divided sulphurs, but none will be recommended until further tests have been made.

Singh (B.). **Bovine Trypanosomiasis in Central Provinces with an Account of some recent Outbreaks.**—*Indian J. vet. Sci.* **6** pt. 3 pp. 243–250, 3 pls., 6 refs. Delhi, September 1936.

Records of recent outbreaks of severe bovine trypanosomiasis in India are reviewed, and an account is given of some cases in the Central Provinces. The author hesitates to identify the disease concerned with surra (defined as the form of trypanosomiasis caused by *Trypanosoma evansi* alone), as it presents certain unusual features. One of these is the frequency with which it progresses to a fatal issue, whereas *T. evansi* is usually considered as innocuous to cattle [*cf. R.A.E.*, B **20** 12]. The course of the disease and its treatment are described and statistics given. Working bullocks were more susceptible than other cattle or buffalos, and a mortality of 96 per cent. was recorded in one outbreak. The area chiefly affected was covered with a tall thick grass and subject to flooding in the rainy season, following which the disease appeared. Outbreaks occurred from August to November, and some cases were observed until January. Blood smears taken from affected cattle showed *T. evansi* in each case. *Hippobosca maculata*, Leach, and the ticks, *Hyalomma aegyptium*, L., and *Boophilus annulatus microplus*, Can. (*australis*, Fuller), were collected from some of the affected cattle. Blood smears made from some of the ticks failed to show trypanosomes.

RAO (M. A. N.) & PILLAY (M. R.). **Some Notes on cutaneous Myiasis in Animals in the Madras Presidency.**—*Indian J. vet. Sci.* **6** pt. 3 pp. 261–265, 1 ref. Delhi, September 1936.

In investigations in Madras from December 1934 to November 1935, 401 maggots obtained from fly-blown sores on various domestic animals were identified as *Chrysomyia bezziana*, Villen., and 3 from bullocks as *Lucilia cuprina*, Wied. (*argyricephala*, Macq.). Breeding experiments with *C. bezziana*, *C. megacephala*, F., and *L. cuprina* showed that the first is restricted to wounds, while the other two can breed easily in dead meat. *C. bezziana* was recorded from the cloaca of four fowls in different localities, and also from two sheep. Infestation appeared to be greatest on the west coast, where rainfall and humidity are high. For all months except May and June (the hottest of the year) the pupal stage averaged 7 or 8 days ; in May and June no adults emerged, whereas in December and January 95 per cent. did so. The optimum period appeared to be from December to March, while fewer adults emerged during the hot season.

Oestrids that infest domestic animals in Madras are *Oestrus ovis*, L., in sheep, *Gastrophilus intestinalis*, DeG. (*equi*, Cl.), in horses, and *Cobboldia elephantis*, Steel, in elephants. No examples of *Hypoderma bovis*, DeG., or *H. lineatum*, Vill., have been recorded in the Presidency.

CHUNG (H. L.) & FENG (L. C.). **Studies on the Development of** *Spirochaeta recurrentis* **in Body Louse. A preliminary Report.**—*Chin. med. J.* **50** no. 9 pp. 1181–1184, 5 refs. Peiping, September 1936.

This is a preliminary report of investigations made in China on the development of *Spirochaeta recurrentis* in lice [*Pediculus humanus*, L.]. Batches of laboratory-bred lice, 12, 13, 14, 16 and 18 days old and free from spirochaetes, were fed once for 1–3 hours on a relapsing fever patient whose blood contained 20–30 spirochaetes per oil immersion dark-field. They were subsequently fed on individuals free from relapsing fever to keep them alive, and some were dissected at intervals of 2 hours for 8 hours after the infecting feed and then daily until the 18th day, when all had died. The results of the dissections are tabulated. Spirochaetes that remained in the stomach all died in the course of 8 hours, but living spirochaetes were found in the legs and coelomic fluid from 2 hours after the feed until the 18th day. No living spirochaetes were found in the faeces and no dead ones after 6 hours. Relapsing fever was transmitted to splenectomised squirrels by inoculating them with motile spirochaetes from the stomach contents or from the legs and coelomic fluid, the latter recovered from the lice 3–13 days after the infecting feed, while similar inoculations with faeces of infected lice had no result. No spirochaetes were observed in the Malpighian tubes, salivary glands, ovaries or testes of the lice, or in eggs or nymphs derived from heavily infected females, and inoculation with the crushed contents of the eggs and nymphs failed to infect splenectomised squirrels. Experiments showed that the spirochaetes were not transmitted from either sex of the louse to the other during the act of pairing.

The authors conclude that most of the spirochaetes ingested with an infected blood meal are killed and digested in the stomach by the gastric juice. Only 1–5 per cent. or less gain access to the tissues or

coelomic cavity, where they multiply by transverse division, and they penetrate the wall of the alimentary canal soon after the infective feed. There is no reason for accepting the theory of the occurrence of invisible forms of spirochaetes in the lice as a developmental phase in the life-history of *S. recurrentis* [*cf. R.A.E.*, B **1** 71].

FENG (L. C.) & CHUNG (H. L.). **Studies on the Development of *Spirochaeta duttoni* in *Ornithodorus moubata*. A preliminary Report.**—*Chin. med. J.* **50** no. 9 pp. 1185–1190, 9 refs. Peiping, September 1936.

These investigations were made in view of the divergent opinions as to the development of *Spirochaeta duttoni* in *Ornithodorus moubata*, Murr., held by different workers, some of whom consider that granules are a phase of its development [*cf. R.A.E.*, B **18** 103; **9** 85]. Young nymphs of *O. moubata*, obtained from eggs laid by non-infected adults, were fed once on the blood of rats containing about 20 spirochaetes per oil immersion field and were kept at 25–30°C. [77–86°F.]. Some were dissected after the infecting feed at intervals of 2, 6 and 24 hours and thereafter daily or every second day. In all, 52 ticks were dissected in 41 days and spirochaetes were found in all. The number of spirochaetes in the stomach contents began to decline after 24 hours, but some were found until the 11th day. All were actively motile, and dividing forms were observed. Spirochaetes were observed in the legs and body wall after 6 hours, and in the salivary glands, including the acini and salivary ducts, and coxal glands and reservoirs from the 4th day. Spirochaetes were also observed in the nerve ganglion, but none in the faeces or within the Malpighian tubes of infected ticks [*cf.* **24** 278]. The intraperitoneal injection of suspensions of the negative Malpighian tubes and faeces failed to infect mice that were normally infected with spirochaete-positive organs. This indicates that the granules present in the Malpighian tubes had no connection with the life-history of the spirochaetes. No granular phase was observed and spirochaetes as such were continuously present. The authors conclude that shortly after the infection, spirochaetes penetrate the stomach wall of the tick and appear in the body cavity, from which they invade the salivary glands, possibly causing bites to become infective, the nerve ganglion, the coxal glands and their reservoirs. Multiplication as spirochaetes by transverse division takes place in these organs as well as in the body cavity, and after the 3rd or 4th day numerous spirochaetes can be found in these situations.

CAMINOPETROS (J.) & TRIANTAPHYLLOPOULOS (E.). **Existence en Grèce d'une fièvre récurrente dont le spirochète revêt les caractères de *Spirochaeta hispanica*, agent de la fièvre récurrente hispano-africaine.**—*Ann. Parasit. hum. comp.* **14** no. 5 pp. 429–432, 2 refs. Paris, 1st September 1936.

The authors record the occurrence since 1933 of a number of cases of relapsing fever in the plain of Messenia. The sporadic incidence and the benign nature of the disease suggested that it was of the tick-borne type. A relapsing fever spirochaete was found in the brains of field rats during an investigation carried out on the spot in October 1934. The infection from man was maintained in guineapigs by injection of infected blood, and a monkey, rabbits, rats and mice were found to be

susceptible. Examples of a laboratory strain of *Ornithodorus erraticus*, Lucas, became infected when fed on infected guineapigs and regularly transmitted the disease to guineapigs after moulting. Ticks infected on 13th November 1935 still transmitted the infection by biting on 8th May 1936. The pathogenicity of the strain to guineapigs and its transmission by *O. erraticus* indicated that it belonged to the group of *Spirochaeta hispanica*. Cross-immunity experiments with a Moroccan strain of *S. hispanica*, obtained from infected examples of *O. erraticus*, confirmed the individual specificity of spirochaetes of this group [*cf. R.A.E.*, B **18** 18, etc.]. No infection resulted when examples of *Rhipicephalus sanguineus*, Latr., from dogs living near infected persons, were allowed to feed on healthy guineapigs, or when lice [*Pediculus humanus*, L.] were injected into guineapigs 7 days after they had fed on an infected monkey. Thus the natural vector of the disease is unknown. As this is the first record of a focus of relapsing fever of this type in the regions north of the Mediterranean, the authors propose for the causal agent the name *Spirochaeta hispanica* var. *peloponesica*.

BRUMPT (E.). **Non transmission de la fièvre récurrente de l'Asie centrale à** *Spirochaeta persica*, **par l'***Ornithodorus canestrinii*.—*Ann. Parasit. hum. comp.* **14** no. 5 pp. 433–435, 7 refs. Paris, 1st September 1936.

The two females of *Ornithodorus canestrinii*, Bir., from Persia [*R.A.E.*, B **23** 146], which had undoubtedly been fertilised by the male that was with them on their arrival in Paris, were still alive in August 1936, but had not oviposited under any of the varied conditions to which they had been subjected. They engorged on a guineapig infected with *Spirochaeta persica* (*sogdiana*) on 2nd February 1935 [*loc. cit.*] and were subsequently kept at a temperature of 25°C. [77°F.] until 5th May 1935, but no infection resulted when one bit a guineapig on this date or when both fed on a guineapig on 1st May 1936.

In addition to its usual vector, *O. papillipes*, Bir. (which the author considers a synonym of *O. tholozani*, Lab. & Mégn.), this spirochaete has been transmitted by the bites of *O. moubata*, Murr., and *O. normandi*, Larr. [**17** 18] and in the author's experiments by *O. erraticus*, Lucas, *O. nicollei*, Mooser, and *O. turicata*, Dugès.

BRUMPT (E.). **Action nulle du froid sur le pouvoir infectieux des argasinés vecteurs de fièvres récurrentes.**—*Ann. Parasit. hum. comp.* **14** no. 5 pp. 436–439, 7 refs. Paris, 1st September 1936.

Early experiments with *Spirochaeta gallinarum* in *Argas persicus*, Oken, showed that the ticks lost their infective power when kept at low temperatures but recovered it when maintained for a short time at higher temperatures. The author suspected that the period at high temperatures was not always necessary, because relapsing fever was contracted through the bites of *Ornithodorus turicata*, Dugès, in a cave in Texas [*R.A.E.*, B **19** 116], where the temperature had certainly been low during the night for several weeks and during the day scarcely rose above 15°C. [59°F.]. In the laboratory, ticks from this source maintained at 12–15°C. [53·6–59°F.] transmitted the infection as regularly as those kept at 25°C. [77°F.].

Further experiments were carried out in 1936 with *Argas persicus* infected with a strain of *S. gallinarum* from Persia (whence the spirochaete is recorded for the first time), *O. erraticus*, Lucas, infected with hispano-african relapsing fever [*S. hispanica*], and *O. papillipes*, Bir. (which the author considers a synonym of *O. tholozani*, Lab. & Mégn.), infected with *S. persica*. These ticks transmitted the respective infections without preliminary heating after being kept for 2–3 weeks in a refrigerator at 5–7°C. [41–44·6°F.].

GALLIARD (H.). **Infestation expérimentale de** *Mansonia indiana* **Edwards avec les embryons de la filaire de Bancroft, au Tonkin.**—*Ann. Parasit. hum. comp.* **14** no. 5 pp. 495–496. Paris, 1st September 1936.

The chief vectors of *Filaria bancrofti* in the Far East are *Culex fatigans*, Wied., and *Anopheles hyrcanus*, Pall., and in Tonkin these two species have been experimentally infected without difficulty [*R.A.E.*, B **25** 5], whereas other domestic mosquitos appear to be refractory. Larvae of *Mansonia indiana*, Edw., which is recorded for the first time from Indo-China, have been found in the delta region of Tonkin near Hanoi. The plant to which they prefer to attach themselves appears to be *Eichornia* (*Pontederia*) *crassipes*. In experiments with *F.* (*Microfilaria*) *malayi* in Java [*cf.* **21** 191], this species showed a high rate of infection. In Tonkin, of 20 examples fed on a man showing 60 microfilariae of *F. bancrofti* per drop of blood, only 5 became infected. Two of these showed a small number of infective larvae at the end of 15 days at a temperature ranging from 28 to 30°C. [82·4–86°F.] ; in the others the larvae were immature. In view of the small number of adults collected in the villages of the delta, the small number of infected persons, the scarcity of microfilariae in their blood, and the difficulty of infecting the mosquitos in the laboratory, it is concluded that *M. indiana* can be of no great importance as a vector of filariasis in this region.

GALLIARD (H.). **Sur la reproduction et la ponte d'***Armigeres obturbans* **Walker au Tonkin.**—*Ann. Parasit. hum. comp.* **14** no. 5 pp. 497–500. Paris, 1st September 1936.

Six generations of *Armigeres obturbans*, Wlk., have been reared in the laboratory at Hanoi. In nature the adults disappear entirely during the whole of the cold season. In the laboratory pairing could be obtained in very small cages. The lowest and highest temperatures at which it occurred were 20 and 33°C. [68 and 91·4°F.] ; under natural conditions neither males nor females were ever found at the lower temperature. A blood meal was necessary before oviposition, which took place after an interval of 48 hours at 28°C. [82·4°F.]. Although numbers of adults invade houses during October and November, no eggs were found in any receptacle. The larvae live only in very polluted water, either in ditches or open sewers. In the laboratory, the females usually laid their eggs close together on the sides of the receptacle just above the level of the water. They preferred to oviposit on stems of plants or small pieces of wood placed in the jars ; but oviposition was also obtained on damp cotton wool or directly on the surface of the water. The gravid females did not appear to be more attracted to water containing food suitable for the larvae

than to distilled water. The tendency for eggs to be laid above the surface of the water explains the fact that adults do not appear until after the first heavy rains ; in 1936 the first female was caught on 12th May. The numbers of eggs varied with the conditions under which the females were kept ; the largest number was obtained from a captured female, which laid 180, all at one time. Females frequently die after laying one batch of eggs, even when conditions appear favourable ; they may lay a second batch after another blood meal but the number of eggs is always lower ; no third batch has ever been obtained. The number of eggs also decreased with the number of generations reared. Larvae fed on the excreta of guineapigs took much longer to develop than those reared on powdered spleen, dried fish or banana pulp ; moreover, the females derived from them were smaller and laid fewer eggs.

GALLIARD (H.). **Procédé de recherche des microfilaires de** *Wuchereria F. bancrofti* **chez les moustiques desséchés.**—*Ann. Parasit hum. comp.* **14** no. 5 p. 519. Paris, 1st September 1936.

In investigations on *Filaria* (*Wuchereria*) *bancrofti*, the mosquitos often die in the course of an experiment, particularly during the hot season, and a number may be dissected sooner than is desirable for fear they should be found dead and dried up. The author describes a process for softening and clearing by means of which it is possible to observe the microfilariae in all stages even when the host has been completely desiccated. It is not, however, possible to mount the specimens intact to determine the exact location of the parasites. The process would also be of value in epidemiological surveys when a large number of mosquitos die during transport to the laboratory.

KITCHEN (S. F.) & BRADLEY (G. H.). *Anopheles walkeri* **Theobald as a Vector of** *Plasmodium falciparum* **(Welch).**—*Amer. J. trop. Med.* **16** no. 5 pp. 579–581, 3 refs. Baltimore, Md, September 1936.

Anopheles walkeri, Theo., has recently been observed in several localities in Florida [*cf. R.A.E.*, B **24** 7], and it has been found that the Florida form constitutes a southern race. As the species has been shown to be an efficient vector of *Plasmodium vivax* [**21** 148], experiments were carried out in 1935 to find whether this southern race can be infected with *P. falciparum*. Various lots of *A. walkeri* together with control lots of insectary-reared *A. quadrimaculatus*, Say, were each applied to the same gametocyte carrier and dissected after 12 days. Of the 9 females of *A. walkeri* tested, only one became infected and only one oöcyst developed, 20 out of 26 controls being infected.

HOFFMANN (C. C.). **Investigaciones palúdicas en la región de Actopan, Hgo.** [Malaria Investigations in the Region of Actopan, State of Hidalgo.]—*An. Inst. Biol. Mex.* **7** no. 2–3 pp. 305–318, 14 refs. Mexico, 1936.

This report is based on observations made in March, April and May. The region of Actopan (central Mexico), has a dry, mesothermic climate, and malaria is not severe, though isolated cases constantly occur.

An examination of school children showed that 3 per cent. were infected in the town of Actopan, and 10 and 14·2 per cent. in two country localities. Except for a few cases of quartan malaria [*Plasmodium malariae*] in the town, all were tertian [*P. vivax*]. The only vector found, *Anopheles pseudopunctipennis*, Theo., is present throughout the year and requires clean water for breeding. During the dry season there are very few breeding places, usually in the beds of streams, but these are swept by the first torrential rains of the wet season, and it is considered that the dispersal of the larvae may involve a risk of the spread of malaria during the period when the temporary breeding places occur. *A. punctipennis*, Say, and *A. maculipennis* var. *aztecus*, Hffm., are found in neighbouring parts of Mexico, but their definite northern character renders it unlikely that they could be established in Actopan.

Rozeboom (L. E.). **The Life Cycle of Laboratory-bred** *Anopheles albimanus* **Wiedemann.**—*Ann. ent. Soc. Amer.* **29** no. 3 pp. 480–489, 6 refs. Columbus, Ohio, September 1936.

This paper gives the results of experiments in Panama on the laboratory breeding of *Anopheles albimanus*, Wied., the methods of which have already been noticed [*R.A.E.*, B **24** 268]. In a test to determine the egg-laying capacity, 10 engorged females and 15 males, which had emerged about 12 hours previously, were enclosed in a breeding cage and fed on sugar-water and fruit, the females being offered human blood daily. On the 8th day, 7 females were still alive and were confined singly in lantern globes over water for oviposition, the globes being within the breeding cages to maintain constant environmental conditions. The females were given daily opportunity to suck human blood. Six of the 7 deposited 2–6 batches of eggs, at intervals of 2–3 days, beginning on the nights of the 9th–12th days. The laboratory colonies, however, required shorter preoviposition periods, the first eggs appearing after 7 days in one case. The number of eggs in a batch varied from 29 to 262, the average of 20 batches being 130. The greatest number of eggs laid by one female was 788, the average being 435. At death, the ovaries of all the females except the one that laid 788 eggs still contained eggs in varying stages of development. It has been stated [**20** 157] that *A. albimanus* deposits an average of only 160 eggs, but its real capacity would appear to be nearer that of *A. tarsimaculatus*, Goeldi, and *A. argyritarsis*, R.-D. [**17** 192]. Of the 2,610 eggs deposited, only 45·5 per cent. hatched. This low fertility may have been due to the fact that the females could not pair after the first batch of eggs matured. After oviposition, all the females fed readily ; one blood meal sufficed for the second and third batches, but occasionally two or three meals were taken between layings. Oviposition began about 6.30 p.m. and ceased at some time before 8 a.m.

The numbers of larvae hatching from 48 batches of eggs are tabulated with the times. The egg stage generally lasted 40–48 hours, although a few of the larvae hatched from eggs more than 59 hours old. Of 18,935 newly-hatched larvae kept in breeding-pans, only 9,327 or 49·3 per cent. reached the pupal stage, but this mortality was largely due to improper treatment. The duration of the larval stage varied from 6 to 22 days at 21–27°C. [69·8–80·6°F.], but was usually 8–13 days, and the pupal stage lasted approximately 30–33 hours at 27–30°C.

[80·6–86°F.], pupation occurring more often during the day than at night [**23** 218]. Of 39,782 pupae obtained during 6 months, 85·4 per cent. produced adults. In most cases emergence began between 3.30 and 5 p.m. and was completed by 10 p.m. [**23** 218]. Thus an average of about 3 weeks is required for the development of a generation. Of the adults, 10·7 per cent. died during or shortly after emergence. Of the 10,003 that lived, 57·3 per cent. were females. Females were ready to suck blood on the morning after emergence, and pairing, which occurred in flight, was observed during the short twilight from about 6.30 to 7 p.m. and also at about 6.30 a.m., but never during the day or night. Females were able to mate before having taken blood, and a number of eggs deposited by females that took their first blood feed after mating proved fertile. The maximum length of life observed in the adult stage was 31 days for a female and 24 for a male.

LANE (J.). **Notas sobre mosquitos de São Paulo.**—*Bol. Inst. Hyg. S. Paulo* no. 60, 17 pp., 5 pls., 18 refs. S. Paulo, 1936. (With a Summary in English.)

The mosquitos here recorded from the State of São Paulo include *Wyeomyia arthrostigma*, Peryassú (*petrocchiae*, Shannon & Del Ponte), *Aëdes leucoceleanus*, Dyar & Shannon, and *Psorophora ferox*, Humboldt, on all three of which were found eggs of *Dermatobia hominis*, Say; and *Anopheles parvus*, Chagas, and *A. lutzi*, Cruz, which were attracted to man in the region of the Paranapanema river.

BAISAS (F. E.). **Notes on Philippine Mosquitos, V. The pupal Characters of Anophelines under the *Myzorhynchus* Series and Group *Neocellia*, with further Comments on the Larvae and Adults of** *sinensis*.—*Mon. Bull. Bur. Hlth Philipp. I.* **15** no. 9 pp. 291–339, 23 pls., 4 figs., 36 refs. Manila, September 1935. [Recd. 1936.]

In the Philippines, the *Myzorhynchus* series is represented by *Anopheles barbirostris*, Wulp, *A. gateri*, Baisas, *A. hyrcanus* var. *nigerrimus*, Giles, *A. hyrcanus* var. *sinensis*, Wied., and *A. pseudobarbirostris*, Ludl., and the *Neocellia* group by *A. annularis*, Wulp, *A. karwari*, James, *A. maculatus*, Theo., and *A. philippinensis*, Ludl. Keys are given to the pupae of these species; the pupal characters are described, and the variations in the different dorsal hairs and spines and in the indices of the paddles (obtained by dividing the greatest length by the greatest width) are tabulated. It is shown that two varieties have hitherto been confused under the name *A. hyrcanus* var. *sinensis*; this name is retained for the variety occurring in the highlands and the lowlands, and the name var. *pseudosinensis*, n., is given to that found only in the lowlands. The characters distinguishing these forms in the larval, pupal and adult stages are discussed.

EJERCITO (A.), MENDIOLA (J. C.) & BAISAS (F. E.). **Can Malaria be contracted in Manila ?**—*Rev. filip. Med. Farm.* **27** no. 6 pp. 243–262, 1 fig., 6 refs. Manila, June 1936.

In an attempt to establish whether malaria can be contracted in Manila, the authors made investigations in 1933–35 on reported cases, the prevalence of malaria in the area of the city most concerned, and its Anopheline population. Of 81 cases confirmed from 1st March 1933

to 31st October 1935, all had probably contracted the disease in the provinces. They included 3 cases, however, that appeared to incriminate the Santa Ana district of Manila, and a survey of the inhabitants of 80 per cent. of the houses in it was therefore made. Of 62 children under the age of ten, two showed splenomegaly and none a positive blood test, while of 192 persons over ten, one showed a positive blood test and none splenomegaly. Similar tests in the local elementary school, in which 214 persons were examined, gave negative results.

Observations made from 18th August to 15th November 1935 on Anophelines in this district of Manila, a circle with a radius of nearly a mile, showed that at first very little breeding took place, owing to floods and heavy rains, but gradually more breeding was observed, the amount falling again at the end of October, owing to the drying up of pools, etc. Of 631 Anopheline larvae collected and identified, 346 (55 per cent.) were *Anopheles hyrcanus* var. *nigerrimus*, Giles, and 227 (36 per cent.) *A. vagus* var. *limosus*, King. The others were *A. annularis*, Wulp (11), *A. barbirostris*, Wulp (2), *A. hyrcanus* var. *sinensis*, Wied. (13), *A. philippinensis*, Ludl. (22), *A. subpictus* var. *indefinitus*, Ludl. (9), and *A. tessellatus*, Theo. (1). Dissections were made of 983 adult females belonging to all these species, 189 of these being *A. hyrcanus* var. *nigerrimus*, 191 *A. subpictus* var. *indefinitus*, and 512 *A. vagus* var. *limosus*, and the results are tabulated. None was infected. No examples of *A. maculatus*, Theo., or *A. minimus* var. *flavirostris*, Ludl., the vectors of malaria in the Philippines [*cf. R.A.E.*, B **22** 258; **23** 99], were found, although suitable breeding places exist, no Anophelines were caught inside houses and very few outside in their vicinity, and most of them were caught near buffalos, cows and pigs.

In accordance with this evidence, it is concluded that malaria is not contracted in Manila.

Williamson (K. B.) & Scharff (J. W.). **Anti-larval Sluicing.**—*Malay. med. J.* **11** no. 3 pp. 123–150, 2 diagr., 11 pls., 24 refs. Singapore, September 1936.

This paper includes a general account of the method of sluicing for the control of eggs and larvae of Anophelines, chiefly *Anopheles maculatus*, Theo., in Malaya [*cf. R.A.E.*, B **24** 48; **23** 273, etc.]. Points treated include the distinction between emptying and sluicing water channels, with some discussion of the forces at work in a sluice-wave, the emptying of a channel above a sluice-gate combined with the sluicing of the channel below it [**20** 122], the history of anti-malarial sluicing outside Malaya, and the early development of the method. Experiments were carried out in 1930–33 at a hill station in the Cameron Highlands [**21** 66] where *A. maculatus* was found breeding in drains and ravine streams, although these had been canalised. In 1930–31, the average number of larvae brought in monthly by collectors was 436. Roughly 100 acres in this area were flushed by sluice-gates or automatic tippers during a period of several months. After this period, three trained collectors found no larvae in sluiced channels, although larvae of *A. maculatus* were found in channels that had not been sluiced. These also were eliminated by the same method. In the last 17 months of the experiment, from November 1931, 20 larvae of *A. maculatus* per month were taken. Almost all of these came

from new breeding places, and none from sluiced channels. Larvae reappeared after 3 weeks in a ravine in which sluicing had been interrupted.

In an experiment carried out in the lower Highlands in July-October 1932, to compare the relative efficiency of fortnightly brush oiling [**22** 148] and a partial sluicing with tippers discharging 60–70 gals., 3 ravines brush oiled yielded 35 Anopheline larvae in 8 searches, 3 sluiced ravines yielded 31, and 3 control ravines yielded 366.

In reply to criticisms [**23** 273], the authors discuss the general principles and applicability of the method. That fears of the larvae being washed downstream alive are unfounded was shown by experiments in which coloured match-sticks, short lengths of wire and larvae were placed at the top of a channel 825 ft. long that was to be flushed. After sluicing, the wires were buried under silt *in situ*, the match-sticks were mostly stranded on the sides of the stream and in pools, which could be drained or filled up, while in two experiments only 3 out of 740 larvae were recovered from the lower reservoir. This demonstrated the small transporting power of a flush, its chief action being in the shock it causes, and the turbulence by which it is accompanied. This latter may be increased by placing rocks in the stream. Erosion of friable soils should not normally exceed that caused by natural spates or flood rains, as there is an actual saving while the reservoir is allowed to fill, assuming that no overflow or escape is permitted. Pot-holing at the point where the water falls from the reservoir when the gates are opened might be remedied by reinforcing the bed of the stream with stones. The danger of Anophelines breeding in impounded headwaters may be eliminated by erecting the sluices as high upstream as possible and by the use of Paris green. It is emphasised that sluicing can be effective only when used with other methods. The breeding of Anophelines that avoid shade, such as *A. maculatus*, might be prevented by allowing jungle to spring up.

CRAIG (W. J. F.). **Malaria Prevention Methods in Java. Report on the League of Nations Second (International) Course of Malariology, 1935.**—*J. R. Army med. Cps* **67** no. 4 pp. 233–245, 2 figs. London, October 1936.

A brief account is given of the information on the measures employed against Anopheline larvae for the control of malaria in Java obtained during the second international course on malariology held in Java in June 1935. The measures include draining and filling, the control of breeding in fish-ponds and, against *Anopheles maculatus*, Theo., the planting of shade trees.

Premier voyage international d'études malariologiques de la S.D.N., en Indochine Française.—*Bull. Soc. méd.-chir. Indochine* **14** no. 6 pp. 486–679, 6 figs., 1 graph, 1 diagr., 4 maps (3 fldg.). Hanoi, 1936.

After attending the third international course on malariology held at Singapore under the auspices of the Eastern Bureau of the League of Nations, some of the delegates made a tour of Indo-China lasting three weeks in June 1936. The papers read to them are published here. Those of entomological interest are concerned with malaria occurring in different parts of Indo-China under different conditions, and with

the various measures against Anopheline larvae that are undertaken for its control. They deal with malaria in Tonkin, Annam, and Cambodia ; in towns, villages, rice-fields, coastal areas, and plantations in the south ; and among the personnel engaged in railway construction and in the army. The subjects of those that refer solely to Anophelines are the maxillary indices of Anophelines, the part played by the so-called secondary vectors, and the mosquito fauna of Tonkin.

Chin (Y. T.). **On some Mosquitoes collected from Manchuria.**—*Peking nat. Hist. Bull.* **11** pt. 1 pp. 23–25, 5 refs. Peiping, September 1936.

This paper contains brief notes on mosquitos collected from four areas in Manchuria. They comprised *Anopheles hyrcanus* var. *sinensis*, Wied., which bred in lakes and ponds having plenty of surface vegetation, 4 species of *Aëdes* and 7 of *Culex*.

Sokolov (N. P.). **L'acclimatisation du** *Gambusia patruelis* **en Asie centrale.**—*Riv. Malariol.* **15** no. 5 pp. 325–344, 11 figs., 25 refs. Rome, 1936. (With Summaries in English and Italian.)

An account is given of the introduction of *Gambusia* into Turkestan in 1935 for the control of Anopheline larvae in rice-fields and of observations made in connection with it from May to September of that year. The temperature of the water in the fields was very high during the day. Both the temperature and the oxygen content varied considerably at different hours, but the pH changed only slightly, the reaction being almost neutral. The fertility of *Gambusia* depended on the age of the fish, females 2–3 years old, which are 45–50 mm. long, being the most productive. The young reached maturity in the very short period of 36–40 days, so that 4–5 generations can occur during one season from the sowing to the ripening of the rice. Analysis of the stomach contents showed that Culicines represented 20 per cent. of the food of the adults and Anophelines 32·8 per cent. In the young fish, the only mosquito larvae found were Anophelines ; they represented 64·8 per cent. of the food. The numbers of Anopheline larvae in rice-fields containing *Gambusia* were reduced by about 90 per cent., as compared with fields not stocked with the fish. The latter were introduced at the rate of 2 or 3 per square yard.

Gioseffi (M.). **Malaria e lotta antimalarica in Istria (1 novembre 1934–31 ottobre 1935).** [Malaria and anti-malarial Work in Istria from 1st November 1934 to 31st October 1935.]—*Riv. Malariol.* **15** no. 5 pp. 370–381. Rome, 1936. (With Summaries in English and German.)

A continued decrease of malaria in Istria [*cf. R.A.E.*, B **23** 115] occurred during the year under review, especially in the Quieto district. The numbers of Anophelines were also much reduced, owing to the reclamation work and to the exceptionally dry weather, which dried up about 90 per cent. of the pools. From Anophelines captured in stables, 654 batches of eggs were obtained, of which 449 were attributed to *Anopheles maculipennis* race *messeae*, Flni, 140 to race *maculipennis* (*typicus*), 34 to race *melanoon*, Hackett, and 31 to *A. sacharovi*, Favr (*elutus*, Edw.). Of 25 batches laid by mosquitos captured in dwellings,

18 were attributed to *A. sacharovi*, 4 to *messeae*, 2 to *maculipennis* and 1 to *melanoon*. From June onwards, *A. sacharovi* disappeared from the Quieto district, evidently because the brackish water breeding places at the mouth of the Quieto river were eliminated, owing to the completion of a bank separating the fresh water from the sea. In the Arsa zone, about 95 per cent. of the Anophelines belonged to race *messeae* and the rest to race *maculipennis*.

[SIMIĆ (Ch.).] SIMITCH (T.). **Etudes sur la malaria dans la Serbie du sud, Banovine du Vardar.**—*Bull. Off. int. Hyg. publ.* **28** no. 9 pp. 1690–1734, 1 map. Paris, September 1936.

Some of the information in this discussion of the epidemiology of malaria in the Vardar Province of southern Serbia is similar to that already noticed [*R.A.E.*, B **24** 287 ; **18** 3 ; **17** 219, etc.]. Figures are given showing the average monthly temperatures and rainfall for Skoplje for the period 1925–34. Certain regions in the south-east of the Province have an average temperature of over 2°C. [35·6°F.] in January, which favours the early renewal of activity of the hibernating Anophelines. The actual amount of rainfall is less important than its seasonal distribution, for the lower the rainfall from June to September, the more favourable are the conditions for the development of *Anopheles superpictus*, Grassi, in slow-flowing sections of rivers and streams, while heavy snow-falls in winter and much rain in March, April and May favour the development of *A. maculipennis*, Mg., in stagnant water in the plains. Both species hibernate in the adult stage [**18** 3], and while *A. maculipennis* begins to oviposit at the end of February, *A. superpictus* does not do so until a month later and its development is hindered by spring floods [**16** 95]. Thus, under average conditions, *A. maculipennis* is numerous from the end of April, but *A. superpictus* not until August, even in the same area. The appearance of adults of the first generation of *A. maculipennis* is directly dependent on temperatures in early spring, and has been observed from the first half of April to the end of May, but usually in the second half of April.

Malignant tertian [*Plasmodium falciparum*] is common to the south and south-east, and rare to the north, of Skoplje, benign tertian [*P. vivax*] is common in this northern region, while quartan [*P. malariae*] is relatively unimportant in southern Serbia, constituting only 1 per cent. of all cases. Statistics and a graph are given showing the monthly distribution of malaria for the years 1927–35, from which it is evident that there is considerable variation in the dates of malaria peaks, that 30 per cent. of all cases occur in the first half of the year, 90 per cent. of these being benign tertian and about 6 per cent. malignant tertian, and that about 94 per cent. of all cases of malignant tertian occur from July to September. But in spite of annual variations, a sudden rise of benign tertian in May and the appearance of malignant tertian in the second half of July never fail.

In an examination of school-children in Skoplje during the years 1929–33, it was observed that of all cases of benign tertian, 22·6 per cent. were relapses, and that of these 84·5 per cent. occurred from January to July. The interval between the original attack and a relapse was irregular, and some space is devoted to a discussion of relapses in general. Most of the spring cases were not relapses [**17** 219]. As in practice new infections cannot be expected earlier than 40 days after the appearance of the new generation of Anophelines,

allowing 2–3 weeks for the mosquito to become infective and about 6 days for incubation in man, these cases are attributed to protracted incubation [*cf.* **18** 52]. The fall in the malaria curve in June is due to the exhaustion of the spring cases and relapses, while cases of infection from the new Anophelines have not yet matured. Thus benign tertian in the spring is due to relapses and cases of protracted incubation, and in the summer and autumn to new infections. The late appearance of malignant tertian, which rarely causes relapses, is due to the restricted numbers of gametocyte carriers available in the earlier months of the year.

BARBER (M. A.), RICE (J. B.) & MANDEKOS (A. G.). **The Relation of the Density of the Anopheline Mosquitoes and the Transmission of Malaria.**—*Amer. J. Hyg.* **24** no. 2 pp. 237–248, 2 refs. Baltimore, Md, September 1936.

BARBER (M. A.), MANDEKOS (A.) & RICE (J. B.). **The Seasonal Incidence of Malaria Transmission in Macedonia.**—*T.c.* pp. 249–267, 1 chart, 4 refs.

The study reported in the first paper was made in two groups of villages in Greek Macedonia in 1933–36. As *Anopheles sacharovi*, Favr (*elutus*, Edw.) appears to be the only important vector of malaria in the region [*R.A.E.*, B **24** 35], it is the only species considered. The four indices used for comparison were the density index of the mosquito (average number per collection in houses and stables), the transmission index, which was the parasite index of infants one year old or less, the parasite index of children 1–15 years old, and the sporozoite index (percentage of mosquitos showing sporozoites). Mosquito densities were based on collections in June, July and August, because it was found that most of the transmission takes place during these months [see second paper].

In the first group of villages, malaria was highly endemic, numerous brackish and fresh water ponds constituted permanent breeding places for *A. sacharovi*, and the parasite index for 1933–35 was continuously high. The sporozoite indices for June-August and for the whole season differed little and are very near the average for a period of 4 years. In one village where the transmission index was very high, the sporozoite index did not differ greatly from that of the total of the 6 villages, but the density of *A. sacharovi* was far higher, indicating that transmission increases with the density of the mosquito. No evidence was obtained that there is an upper limit of density above which transmission decreases. A sporozoite index of 1·5–2·0 seems to be sufficient to account for high transmission. Gametocyte carriers were rarely, if ever, lacking in this extremely malarious region.

In the other group of villages, the breeding of *A. sacharovi* was less constant and decreased after 1931 owing to a deficiency of rainfall, especially in the winter and spring. The parasite index was high in the spring of 1932 but fell during subsequent years. Thus, in this region, gametocyte carriers were plentiful, at least in the earlier years, but the mosquito density was low. The results in 1933 and 1934 show a low density of *A. sacharovi* coinciding with a low infant parasite index and a declining parasite index in older children. In 1934, the infant parasite index of all villages except one fell to zero, although *A. sacharovi* was still present in small numbers. It is probable that the

mosquito density was near the minimum required for transmission. During 1935, a slight rise in the densities of *A. sacharovi* in two villages was followed by a considerable increase in the transmission indices. It has not been possible to postulate any definite ratios between density and transmission, or to establish a "threshold" of density on the basis of the figures obtained.

It was found that a temporary increase in the numbers of the vector does not always lead to increased transmission, and it is possible that this may be explained by the absence of an effective gametocyte carrier at the time of the invasion. In temperate regions, localities have been found where Anophelines were few, their sporozoite index high and malaria very prevalent, but the mosquitos have usually proved to be the survivors of much larger numbers occurring earlier in the season, and it is questionable whether a very few Anophelines can maintain a high parasite index where the malaria season is short, especially if most of them are attracted to domestic animals.

Methods of determining mosquito density are discussed. In Macedonia, *A. sacharovi* tends to congregate in villages, and houses or stables in which Anophelines seemed to be most abundant were used as catching stations. Cattle in pens near barns or houses are an important factor in making catches, since the Anophelines bite in the open and seek the nearest convenient resting places. Thus, not only must the nature of the catching station be taken into account, but also its environment, and the species and condition of the mosquitos. As these factors are impossible to standardise, the use of a standard catching station suitable for all regions would appear to be impracticable.

In the second paper are given the results of a study of the seasonal incidence of malaria transmission made in Greek Macedonia during 1932–35. The conclusions are based largely on the parasite index of infants under 1 year of age [*cf.* **24** 310]. It appeared that little, if any, transmission took place from December to April, inclusive; but transmission occurred during May and June, and reached a maximum in July–August. The amount of transmission in September was probably relatively unimportant, and in October and November it was very small. Transmission was related to the density of *A. sacharovi*, which in turn depended on the amount of rainfall, especially that of winter and spring. In one village, a large number of mosquitos were found infected in winter, but the sporozoite index fell steadily until March and then more abruptly, and degeneration appeared in both oöcysts and sporozoites. There is little evidence that mosquitos in this region play any important part in carrying infection from one year to another. Only a few infected mosquitos were found in March and none in April in any of the surveys made. Thus malaria transmission does not run parallel with the sporozoite index, either in summer or winter. The relationship is modified by other factors such as the density of the mosquito and its habits. In every year the density reached a maximum in July and then declined; in July and August there is a combination of high density with warm days and nights, and the sporozoite index is sufficiently high to account for a fair amount of transmission. The seasonal biting habits of this mosquito, as judged by the proportions with a large amount of fat and with well-matured eggs, and by the proportion containing fresh blood, are also of importance. A fairly high percentage contained fresh blood from April to October, inclusive; during the rest of the year the

percentages were lower, the minimum being in December. It is probable that the frequency of biting decreases with the cooler nights in September and does not again reach a high level until the following spring or early summer. In December and January, nearly all the examples of *A. sacharovi* were found in stables, and out of 64 positive reactions in precipitin tests only one was for human blood. In February–April, they began to enter houses, where the percentage positive for human blood was 81·1 ; among the large numbers present in stables this percentage was only 0·8, and it is probable that the total percentage that had bitten man was small. In May and June it diminished in houses but remained high ; in stables it increased to 7·6. In July–September, it fell in houses to 57 and rose in stables to 9·1. This means that a large number of mosquitos were then attacking man, because the proportion now found in stables was fully twice that found in houses. The houses are more often open at night and many of the people sleep out of doors, so that the percentages positive for human blood in houses and stables are more nearly alike. In October and November, the percentage in stables fell to 2·6 and that in houses increased to the spring level.

The rate of development of sporozoites and their viability are also of importance. The rate of development of oöcysts of *Plasmodium vivax* and *P. falciparum* is very low in October and November and is probably so during the cool weather of early spring. Thus in spring sporozoites would appear relatively late in the season and in autumn would hardly mature before the mosquitos seek their winter quarters. In winter 75 per cent. of the sporozoites were partly or wholly degenerated. Nearly all sporozoites formed in summer and persisting into autumn would likewise be subject to the effects of both age and cold.

From these observations, it would appear that if anti-malaria measures are attempted where resources are limited, the best effects will be obtained by applying them in June, July and August. Undoubtedly the seasonal incidence of malaria transmission varies with climate and locality, and probably varies in the same locality in warmer or cooler years, but no striking differences were observed in the region under discussion over a period of 4 years under varied meteorological conditions.

Mer (G. G.). **Experimental Study on the Development of the Ovary in** *Anopheles elutus*, **Edw. (Dipt. Culic.).**—*Bull. ent. Res.* **27** pt. 3 pp. 351–359, 3 refs. London, September 1936.

The factors responsible for hibernation in Anophelines are not yet known, but retardation of ovarian development is one of the associated phenomena. An experimental study of ovarian development in *Anopheles sacharovi*, Favr (*elutus*, Edw.) under different conditions, described in the present paper, was therefore made in Palestine in the hope that the results might help to elucidate the problem.

In newly-emerged females, the pupal air tubes were intact, the mid-gut contained a brownish green amorphous mass, the ovaries in most cases were very small, and the follicles contained 8 undifferentiated cells. Only occasionally were the follicles in a later stage of growth ; their development appeared to be further advanced in larger females than in smaller ones. If the females are kept without food or water, the pupal remains are slowly resorbed, the brownish

mass is passed out through the hind-gut, the ovaries increase in size, and the follicles show further development. The rate of this further development depends on temperature, but in unfed females it never goes beyond stage II of Christophers [in which yolk granules appear and increase in numbers and the ovum develops until it occupies half the follicle]. It is probable that this early ovarian development occurs at the expense of reserves accumulated during larval life. In females of the hibernating generation, initial development of the ovary is impaired and could not be remedied by keeping the adults at a summer temperature. On the other hand, when the aquatic stages of the hibernating generation or the pupae only were exposed to high temperatures, the initial ovarian development in the females produced was more or less similar to that in summer generations.

Ripe eggs were formed in only a small number of females given one feed of blood within 24 hours of emergence, their number being proportionately greater in the larger individuals. Moreover, in practically all the larger females in which mature eggs did not form, the ovaries developed to stage II, and in the smaller ones the proportion that reached stage II was greater than would have been expected if no food had been taken. After a second blood meal, a larger number of females produced ripe eggs, and all the others reached stage II. In females that emerged in November and December and were given a single blood meal, none of the eggs matured, and in more than half, the ovaries did not develop to stage II. Eggs did not mature when the females were fed on raisins only, but a certain amount of fat was accumulated and the ovaries developed up to stage II. In those given a blood meal after having been fed on raisins for 7 days, mature eggs were formed in practically all cases regardless of the size of the female. This result differs from that in which one blood meal but no raisins were given. From experiments it appears that feeding on raisins brings ovarian development up to stage II, and only after this stage is reached can a single blood meal lead to ripening of the eggs. It is suggested that the inability of the ovary to develop to stage II unless the mosquito has fed, and the slow rate of development at the low temperature then prevailing are factors producing the so-called semi-hibernation state in *A. sacharovi* in Palestine.

None of the females used in the laboratory was fertilised, whereas in nature they all become fertilised sooner or later. It seems certain, however, that although fecundation stimulates oviposition, it does not influence ovarian development. Observations made on females caught in nature will be published elsewhere, but as some of them agree with the laboratory findings and support the supposition that these hold good in nature, they are summarised as follows: In multiparous females of *A. sacharovi* the ovaries are always at stage II after oviposition, and with few exceptions, a new set of eggs is formed with one blood meal. Nulliparous females are very often found with the diverticulum distended with some juice of unknown nature, indicating that some plant food has been taken before the blood feed. During the summer months nulliparous females with the gut full of freshly ingested blood and the ovary below stage II are seldom found, while at the beginning of hibernation they are found regularly. The temperature of the breeding places at the beginning of the hibernation period (at the end of October 1934) was the same as that in late March and April 1935, and it is a fact that the first spring generation of *Anopheles* still exhibits to a certain extent the gonotrophic dissociation

characteristic of the hibernating mosquitos. Hibernating females of *A. sacharovi* that emerged in November and the first half of December have been found breeding at a temperature lower than that of April or even March.

Roy (D. N.). **On the Rôle of Blood in Ovulation in** *Aëdes aegypti*, **Linn.**—*Bull. ent. Res.* **27** pt. 3 pp. 423–429, 1 fig., 4 refs. London, September 1936.

The intimate association between a blood meal and ovulation in mosquitos is recognised, but the manner in which the presence of blood in the stomach influences the formation of eggs is not understood. It is suggested that it may either act as a physico-chemical stimulus to the ovarian follicles, or that certain constituents in the blood may furnish some nutrient material necessary for the development of the eggs. In the investigation here described, an attempt was made to determine the nature of the relationship in *Aëdes aegypti*, L., by weighing the mosquito before and after a full or partial meal of blood and noting the number of eggs deposited. As the weight of a mosquito undergoes considerable diminution in the course of the first two days after emergence, and as at this time it is disinclined to feed, the mosquitos used were approximately 3 days old. The average weight of such a mosquito was 1·32 mg. The amount of blood that can be ingested by mosquitos varies considerably in different individuals, but there is a general tendency for them to feed to repletion. The average weight of blood ingested during an uninterrupted feed was 2·07 mg., and the average number of eggs laid after a single blood meal was 48·4. When the weight of blood ingested was less than 0·5 mg., no eggs were laid ; the smallest amount of blood necessary for the production of eggs was 0·82 mg. When mosquitos that oviposited and those that did not were both considered, the mean number of eggs laid per mosquito progressively increased with the increase in the weight of blood ingested from 7·04 eggs with 0·5–1·0 mg. blood to 85·5 with 3·0–3·5 mg. When only those that oviposited were considered, no definite correlation could be established between the number of eggs and the amount of blood, but with a small amount of blood the number of eggs has a tendency to be smaller. A small amount of blood ingested in 3 successive interrupted feeds had no effect on the mosquitos, but eggs were produced when the weight of blood taken at the third feed exceeded 0·5 mg., although the number was usually small. From experiments in which mosquitos were given interrupted feeds after the first batch of eggs had been laid, it was determined that 0·47 gm. was the minimum weight of blood necessary for the production of a second batch of eggs. It is thought that the amount of blood consumed before eggs are produced is required to stimulate the activity of the ovarian follicles themselves, and that any excess is utilised to form eggs. The number of eggs did not appear to be correlated with the weight of the mosquito ; it probably depends entirely on the amount of blood imbibed.

Moggridge (J. Y.). **Experiments on the Crossing of Open Spaces by** *Glossina swynnertoni*.—*Bull. ent. Res.* **27** pt. 3 pp. 435–448, 4 figs. London, September 1936.

A detailed account is given of experiments carried out in Tanganyika Territory in 1934, during the wet season from the end of February

to the early part of May, and during the dry season from the middle of August to the latter part of September, to determine how far *Glossina swynnertoni*, Aust., may be carried from fly-infested bush by men or cattle, alone or together, for what length of time it may be carried, and at what distance objects moving in the open will attract it to them from the bush.

The following is taken from the author's summaries: *G. swynnertoni* may be carried from fly-infested bush across an open space 1,575 yards wide on cattle (and therefore presumably on game) and on man. The number transported is in inverse ratio to the distance travelled. During the wet season, relatively little difference was noted between the numbers carried across on man and on cattle, but they were small in comparison with those that attacked at the edge of the bush prior to starting. It would appear that the greater the density of the fly in the bush the greater the number carried across. The state of hunger of the flies attracted to the edge of the bush prior to starting would also seem to influence the number transported; the hungrier the flies the less the distance they are likely to be carried before they become engorged and drop off. In the series of wet season experiments with cattle and man together, the average number of flies carried across by man was greater than that carried across by oxen; at the edge of the bush, flies were attracted in greater numbers to cattle than to man, but they left the cattle rapidly, whereas the numbers on man steadily decreased the further the distance travelled. The numbers of flies attracted to the edge of the bush seem to be smaller during the dry season than during the wet, but this is probably due to their density being lower in the late dry season. The decrease in the numbers crossing on cattle during the dry season is considerably more rapid relative to the distance travelled than it is in the wet season. Although the numbers crossing on man alone are less in the wet than in the dry season, in both cases the decrease is gradual.

The flies were not attracted to 5 men and 3 oxen walking through long grass under dry season conditions at a distance from the infested bush of more than 100 yards, but when they walked at this distance for periods averaging 17 minutes, averages of 8 flies were taken. Of a total of 61 flies, 59 were taken on cattle. Flies showed a marked preference for two of the oxen; only 3·39 per cent. of those taken on oxen were from the third animal. In similar experiments carried out later in the dry season, when the ground had been partly burnt and visibility was excellent, a party of 4 men and 3 oxen attracted 1 fly at 300 yards, 4 at 200 and 12 at 100. The average time taken in these experiments was 14 minutes. On two occasions the density of the fly at the edge of the adjacent bush was shown to be considerable.

MOGGRIDGE (J. Y.). **Some Observations on the Seasonal Spread of** *Glossina pallidipes* **in Italian Somaliland with Notes on** *G. brevipalpis* **and** *G. austeni*.—*Bull. ent. Res.* **27** pt. 3 pp. 449–466, 3 pls., 1 fig., 3 refs. London, September 1936.

As *Glossina pallidipes*, Aust., shows a marked preference for feeding on animals rather than man, relatively little attention has been paid to it in the study of sleeping sickness. It is, however, present in areas of Tanganyika Territory where *G. morsitans*, Westw., and *G. swynnertoni*, Aust., occur, and will probably have to be taken into account in designing any large scale measures for their elimination. The

investigation described in the present paper was carried out in Italian Somaliland in January and February 1935 to obtain information on its ecology.

The following is taken largely from the author's summary: *G. pallidipes*, which is the only species of *Glossina* found on the Uebi Scebeli, is concentrated in limited areas during the dry season. In the wet season it increases in numbers and is said to spread over the surrounding country for a distance of 6 miles. Deciduous thicket seems to be an essential constituent of the vegetation that forms its true habitat and breeding place. High humidity and shade are necessary for the spread of the fly, which is capable of penetrating inhabited and cultivated areas. It is not able to maintain itself permanently under conditions of comparatively low temperature and high humidity in vegetation in which *Acacia arabica* and *A. benthami* predominate, if species forming deciduous thicket are absent. Breeding is confined to areas of deciduous thicket; the sites preferred are beneath logs or trees such as *Acacia* with a horizontal growth rather than at the bases of thicket types. Fly may be carried considerable distances by natives bearing loads of firewood from the thickets.

G. pallidipes, *G. brevipalpis*, Newst., and *G. austeni*, Newst., are found in the region of Alessandra, an island in the Juba River. The first species flourishes in deciduous thickets and the second occurs in large numbers in the rain forests, where the third is also found. A fungus pathogenic to tsetse flies is found in this area.

JACKSON (F. W. F.) & others. **Report of the Committee on Human Trypanosomiasis.**—*Rep. med. Dep. Gold Cst 1935* pp. 78–84. Accra, 1936.

This is the report of a committee appointed to discuss the problem created by the apparent increase in the prevalence of sleeping sickness in the Gold Coast. In the first part are given a number of general observations on the nature of the problem and the more general of the recommendations for dealing with it, in the second is set out a scheme for preventive work to be undertaken immediately in the Northern Territories, and in the third is outlined a similar scheme for eventual application in Ashanti.

The apparent increase in the number of cases is undoubtedly due in part to the greater interest taken in the disease and its more accurate diagnosis, and to the increased confidence of the natives arising from the good results obtained by more efficient means of treatment. On the other hand, there has probably been a slight increase in prevalence during recent years, since the opening up of communications has led to more rapid movements of the population and to the consequent introduction of infected persons into fresh areas. In the most seriously infected focus, which lies in the Northern Territories, the incidence varies from 4 to 10 per cent., whereas in the northern part of Ashanti it is about 0·6 [*cf. R.A.E.*, B **23** 132]. The importance of making a survey of the whole Colony is pointed out. In the Northern Territories, *Glossina palpalis*, R.-D., is the usual vector, but *G. tachinoides*, Westw., is also common. These species flourish under similar conditions, and the measures for dealing with them are the same [*cf.* **18** 219]. In the forest zone (Ashanti), *G. palpalis* is again the chief vector, but *G. longipalpis*, Wied., occurs in the scrub that springs up as a result of shifting cultivation and the felling of high

trees for use in mines, and the relation of this fly to the disease is not yet known. The general measures recommended are clearing on the basis of principles laid down by Saunders & Morris [**20** 227] and by Nash [**22** 173] and treatment of infected cases. The paper by Saunders & Morris is reprinted as an appendix. From the data available, the committee was unable to decide whether the presence of cattle effects an increase in fly to a degree dangerous to man.

With regard to the Northern Territories, it is suggested that clearing work at ferries, fords, crossings and water-holes should be intensified and adequately supervised ; the organisation necessary to carry out the work is outlined. In Ashanti, water-holes and water courses are numerous and the cost of clearing far higher than in the Northern Territories, where there are no large belts of heavy forest. Thus expenditure for clearing on the same scale in this region is likely to prove prohibitive. It is suggested that experiments should be made to determine whether cacao trees should be classed as " high " or " low " shade [*cf.* **24** 56]. If it is found that they harbour fly and must therefore be cut down, payment of compensation will be necessary and the cost of clearing will be further increased. A loss of 300–400 trees may result from clearing round one water-hole.

In spite of this it is recommended that the clearing that is to be undertaken in the Northern Territories should be extended to the villages of northern Ashanti. Action over a wider area should, however, be deferred until a survey has shown to what extent other regions are infected. It is suggested that the use of green manure might solve the problem of shifting cultivation, which results in the growth of scrub favouring the presence of *G. longipalpis*. It is recommended that clearing of the cattle route should be undertaken at once in the Northern Territories and extended to Ejura in Ashanti, and that the larger crossings in Ashanti should also be cleared.

STEWART (J. L.). [Report of the] **Veterinary Laboratory.**—*Rep. Dep. Anim. Hlth Gold Cst 1935–36* pp. 9–17. Accra, 1936.

Ixodes rasus, Neum., which was taken on antelopes and rats, is recorded for the first time from the Gold Coast.

The history of the clearing along the Naboggo river and its tributaries, which was begun in 1930–31 with a view to eliminating *Glossina palpalis*, R.-D., is briefly reviewed [*cf. R.A.E.*, B **24** 55 ; etc.], and an account is given of further work in 1935–36, carried out because, in spite of its extent, flies continued to wander into the cleared area. Places to be cleared were ascertained by the recapture of marked flies. Of 3,009 flies marked, 49 were recaptured at distances of 1–6 miles from the points of release. The floras of the Naboggo, its tributaries and other rivers in the Northern Territories have been found to be similar, and lists are given of the trees and shrubs common in the bush fringing the edge of the permanent pools and in the stretches of dry river bed between the pools, of the trees that are usually found growing away from the true river banks but within the area covered by flood water (these are the ones that afford shade to flies of the *palpalis* group when they are driven out of the river bed at the height of the rains, but no pupae are found under them), and of the trees with clean high boles that have been left standing in the clearings. The last are usually found at the top of the banks or within 50 yds. of them ; they do not appear to harbour flies or help in their dispersal during the

wet season. Of 9,478 flies caught during the year, not a single example of *G. palpalis* was taken on the Naboggo River, yet on an uncleared tributary and about two miles distant from the main river, the proportion of *G. palpalis* to *G. tachinoides*, Westw., was 1 to 4 in collections made over a period of 10 days.

As it had been found that flies were entering Yendi town by way of a stream running from a plantation near the town into the Kulpani river 4 miles away, the whole stream and nearly a mile of the river were cleared. The work was completed in the dry season of the year under review, and no flies were caught in the cleared area during this dry season, when both man and cattle were obtaining water at the junction of the stream and the river.

ZUMPT (F.). **Die Tsetsefliegen. Ihre Erkennungsmerkmale, Lebensweise und Bekämpfung.** [Tsetse Flies. Their Characteristics, Life-history and Control.]—Super roy. 8vo, iv+149 pp., 121 figs., 15 pls., 19 pp. refs. Jena, G. Fischer, 1936. Price, paper *M.* 9 ; bound *M.* 10.50.

The interest in tsetse-fly problems shown by Germans in the plantation districts in British Kamerun has led the author to prepare this comprehensive survey of present knowledge on the various species of *Glossina* in a form rendering such knowledge available even to non-zoologists. The work is essentially of a practical character, and the references to the literature are so arranged as to make it serve also as an introduction to a more detailed study. The various chapters deal with the morphology and anatomy of the flies ; methods of collecting and preserving specimens ; classification and identification, with subgeneric and specific keys and notes (covering 55 pages) on the morphology, distribution and ecology of the various species ; the ecological factors relating to the flies ; the methods for investigating ecology ; and control measures.

DA COSTA LIMA (A.). *Flebotomus rickardi* **n. sp. (Diptera : Psychodidae).**—*Rev. med.-cirurg. Brasil* **44** no. 11 pp. 288–289, 2 figs. Rio de Janeiro, November 1936.

Phlebotomus rickardi, sp. n., is described from a male caught indoors, together with both sexes of *P. longipalpis*, Lutz & Neiva, in the State of Ceará (Brazil). Figures are given of its palpi and genitalia, and also of the spermathecae of *P. cruciatus*, Coq. (from Pará) and *P. longipalpis*.

RAYNAL (J.). **Contribution à l'étude des phlebotomes d'Indochine. II. Systématique des espèces de l'Indochine-nord.**—*Arch. Inst. Pasteur Indochine* **6** no. 22 pp. 235–311, 19 pls., 60 figs., 3 pp. refs. Saigon, October 1935. [Recd. 1936.]

This paper contains detailed descriptions of the ten species of *Phlebotomus* recorded in northern Indo-China [*cf. R.A.E.*, B **24** 105], with keys.

TAO (C. S.). **Transmission of Helminths Ova by Flies.**—*J. Shanghai Sci. Inst.* (4) **2** pp. 109–116, 6 refs. Shanghai, April 1936. [Recd. November 1936.]

In 1933, the author placed fly traps containing liquid at 64 different points in Shanghai city and collected some 140,000 flies, chiefly Muscids

and blowflies. After removal of the flies, the liquid in 8 of the traps contained the ova of helminths. Of 206 flies dissected, chiefly blowflies taken in the neighbourhood of latrines, 12 were found to have ova of parasitic worms (*Ascaris*, *Trichocephalus* and *Ancylostoma*) in the intestines. An examination of 30 flies caught failed to reveal any eggs on their bodies, but flies fed in a box on helminth ova were found to carry the ova on their legs. It is concluded that flies that come in contact with helminth eggs may carry them for short distances on their wings and legs and for longer distances in their intestines. In the former case they deposit the eggs during the process of self-cleaning and in the latter case in their excreta.

HERTIG (M.). **The Rickettsia,** *Wolbachia pipientis* **(gen. et sp. n.) and associated Inclusions of the Mosquito,** *Culex pipiens*.—*Parasitology* **28** no. 4 pp. 453–486, 5 pls., 1 fig., 23 refs. Cambridge, October 1936.

A detailed account is given of further studies in Boston on the rickettsia-like micro-organism found in the gonads of *Culex pipiens*, L., and reported in a paper already noticed [*cf. R.A.E.*, B **12** 122], and on large cell inclusions also found in the gonads of this mosquito. The micro-organism has been found in all specimens of *C. pipiens* examined from Massachusetts, Minnesota and China.

The following is taken from the author's summary : The rickettsia, for which the name *Wolbachia pipientis* (gen. et sp. n.) is proposed, is invariably found in the cytoplasm of every germ cell of the gonads in both sexes at all stages of development from larva to adult. No other species of mosquito is known to be similarly infected. The pathological germ cells previously noted in the testis by cytologists were found to occur in both sexes at all stages and are apparently the result of infection with the rickettsia. The problem of classifying rickettsiae is discussed.

Large homogeneous or granular cell inclusions with an affinity for neutral red, termed NR bodies, were found in the gonad wall of nearly every specimen, but were not found in *C. territans*, Wlk. They resemble the inclusion bodies of certain viruses and at times closely simulate masses of rickettsiae, but are apparently distinct from the species here described. They appear to be living agents or manifestations of them. A degenerative process in which the NR bodies replace primary ovarian follicles, in whole or in part, is described. Negative results were obtained in experiments on the inoculation and culture of these two organisms.

SHUTE (P. G.). **A simple Method of rearing and maintaining** *Anopheles maculipennis* **throughout the Year in the Laboratory.**—*J. trop. Med. Hyg.* **39** no. 20 pp. 233–235, 3 figs., 9 refs. London, 15th October 1936.

A description is given of the technique employed in England in rearing *Anopheles maculipennis* var. *atroparvus*, van Thiel, for experimental purposes in the laboratory [*cf. R.A.E.*, B **24** 169]. Unglazed earthenware pans 18–20 ins. in diameter, or shallow water-butts free from resinous notches on the inside, are lined with narrow strips of grass sod cut some distance from tarred roads. A medium-sized tuft is placed in the centre and the pan is three-parts filled with filtered

rain-water. The water is aerated by means of a football bladder or electric pump to disperse any scum before the larvae are added, but if the water is allowed to become too clear the larvae will not have sufficient food. No artificial food is added, and the adults obtained are of good size, living for as long as 4 months and laying as many as 17 batches of eggs. Breeding and oviposition take place readily in the insectary during the summer, but during the winter semi-hibernation sets in in spite of summer temperatures, and most of the gravid females have to be induced to oviposit by placing them in small glass cylinders over Petri dishes containing water. At 75°F., the cycle from egg to adult occupied 16 days. Higher temperatures shortened this period, but the adults obtained were small. Some variations in the eggs have been observed, but they have always been distinct from those of other races.

LAMBORN (W. A.). **The experimental Transmission to Man of** *Treponema pertenue* **by the Fly** *Musca sorbens*, **Wd.**—*J. trop. Med. Hyg.* **39** no. 20 pp. 235–239, 18 refs. London, 15th October 1936.

The literature on the transmission by Diptera of *Spirochaeta* (*Treponema*) *pertenuis*, the causal organism of yaws, is reviewed, and an account is given of the author's experiments in Nyasaland in which the spirochaete was transmitted to man by *Musca sorbens*, Wied., and in which it was shown that transmission of this and other pathogenic organisms may take place as a result of contamination of the proboscis of the fly by regurgitation [*R.A.E.*, B **25** 17, 18].

FRANZ (E.). **Die Bettwanze und ihre Bekämpfung.** [The Bed-bug and its Control.]—*Natur u. Volk* **66** no. 11 pp. 606–608, 1 map. Frankfurt a. M., November 1936.

This note on *Cimex lectularius*, L., records its geographical distribution, and also that of the tropical *C. hemiptera*, F. (*rotundatus*, Sign.), its ability to survive at temperatures down to — 15°C. [5°F.], and the possibility of obtaining effective control by systematic fumigation, especially with ethylene oxide, hydrocyanic acid gas being no longer used in Germany.

HARDY (G. H.). **Notes on Sarcophaginae in India and Australia.**—*Proc. Linn. Soc. N.S.W.* **61** pt. 3–4 pp. 89–97, 7 refs. Sydney, September 1936.

This paper includes notes on the relationship of Indian and Australian species of *Sarcophaga*, and keys to the genera of SARCOPHAGINAE and species of *Sarcophaga* and *Blaesoxipha* found in Australia.

COVELL (G.) & BAILY (J. D.). **Malaria in Sind. Part XV. The Effects produced by the Operation of the Lloyd Barrage Scheme on the Incidence of Malaria in Sind.**—*Rec. Malar. Surv. India* **6** no. 3 pp. 387–409, 1 map, 12 refs. Calcutta, September 1936.

In this paper an attempt is made to assess the effects on the incidence of malaria in Sind of the operation for three years of the Lloyd Barrage Scheme [*cf. R.A.E.*, B **22** 192]. As there is a tendency to attribute

to it most, if not all, of the present incidence of the disease, it is pointed out that certain areas in Sind were constantly highly malarious before a barrage was contemplated, that the Province has been subject to regional epidemics at intervals for at least as long as reliable records have been kept, and that the rainfall, on which the incidence of malaria largely depends, is unevenly distributed and varies greatly in amount each year. Nevertheless, malaria conditions have become considerably worse since 1932, and this is believed to be due to conditions favouring the breeding of Anophelines brought about by the operation of the Scheme. The principal factors concerned are a rise in subsoil water in many localities, actual or threatened water-logging in certain areas, seepage from some of the new canals, the neglect of sections of old canals, the formation of a "lake" above the Barrage and a corresponding rise in the subsoil water level along the course of the Indus, and an extension of rice cultivation in areas outside the Barrage Command in northern Sind, made possible by the increased supply of water available.

The future incidence of malaria due to the Barrage Scheme depends on the success of attempts to provide efficient drainage and prevent water-logging. It is urged that facilities for treatment be increased throughout the area affected by the Scheme and that rest-houses be screened and equipped with electric light and fans. Stress is laid on the importance of making a soil and subsoil survey and of providing an efficient drainage scheme before undertaking any large irrigation project.

Covell (G.) & Baily (J. D.). **Further Observations on a Regional Epidemic of Malaria in northern Sind.**—*Rec. Malar. Surv. India* **6** no. 3 pp. 411–437, 19 graphs, 1 map, 6 refs. Calcutta, September 1936.

Observations on malaria in Shikarpur and certain neighbouring villages in northern Sind were made during the five years following the epidemic in 1929 [*cf. R.A.E.*, B **21** 82]. It was expected, from experience in the Punjab, that the spleen rates in the epidemic area would decrease year by year until they reached their inter-epidemic level in about five years. Various factors, however, interfered with the natural decline, including the unusually heavy rainfall in 1932 and 1933, the extensive floods in 1930 and 1932, and others connected directly or indirectly with the operation of the Lloyd Barrage Scheme [see preceding paper].

A comparison of the Sind epidemic of 1929–30 with that in Ceylon in 1934–35 [*cf.* **24** 115] shows that they have many features in common. Although the latter was preceded by abnormal drought and the former by excessive rainfall, the effect in both cases was to produce unusually favourable conditions for the propagation, longevity and activity of *Anopheles culicifacies*, Giles ; this Anopheline was abundant and its infection rate high ; communal immunity was low ; and economic conditions were adverse, in Ceylon on account of the failure of crops from drought, and in Sind on account of the dislocation of trade and the economic distress brought about by an epidemic of cholera and extensive floods. In both cases infections with benign tertian (*Plasmodium vivax*) were recorded in the early stages of the epidemic and with malignant tertian (*P. falciparum*) later, although in Ceylon *P. vivax* apparently played a more important part than in Sind. In the

Sind epidemic, a large number of cases occurred in the spring of 1930, when climatic conditions were unfavourable for transmission, and at the same time there was a great increase in the rate of infection with *P. vivax*. A feature of the Ceylon epidemic was the second wave of morbidity in the spring of 1935, caused chiefly, if not entirely, by this parasite. It would seem that in both cases this second wave may be attributed to a number of delayed attacks or recurrences of benign tertian in the spring and early summer resulting from infections acquired in the previous autumn during the early stages of the epidemic [*cf.* **19** 119].

The authors do not agree with Gill [**24** 116] that the first rise in the morbidity curve was due to an " epidemic of relapses," but consider that the absence of any appreciable increase in mortality among children might equally well be explained by the fact that the majority of the earlier infections were due to *P. vivax*, or to the numerically poorer infections in Anophelines. Moreover, they point out that an " epidemic of relapses " would be unlikely to occur among a population in which the spleen rate immediately before the epidemic was so low (in Sind in many of the villages that suffered severely it was 5 per cent. or less). An epidemic of relapses presupposes a previous epidemic of primary attacks, and it has also been shown that the occurrence of relapses is not dependent on such environmental factors as season or humidity. They consider that both epidemics may be explained by the sudden production of conditions unusually favourable to the vector in an area where the communal immunity was low, for it has been shown that lack of immunity is the first requirement for the production of heavily infected mosquitos. The result of infection in non-immune persons is that gametocytes are produced more frequently and in greater numbers than in those that are partly immune, so that the number of cases capable of infecting mosquitos is greater.

SENIOR WHITE (R.). **Williamson's " Herbage Cover " Method of Larval Control. A preliminary Note on some Field Trials.**—*Rec. Malar. Surv. India* **6** no. 3 pp. 439–445, 1 pl., 9 refs. Calcutta, September 1936.

An account is given of the application in the field in three localities in Orissa of Williamson's method of " herbage cover " for the prevention of Anopheline breeding in streams [*cf. R.A.E.*, B **23** 130 ; **21** 254]. The first experiment was begun late in October in a stream bed that had been cleared, canalised and oiled for a few weeks ; it was packed to a depth of 3 feet with small branches mainly taken from a Euphorbiaceous shrub of the genus *Cleistanthus*. Anopheline breeding continued for the first fortnight after packing, but must have been slight or of innocuous species, for there was only one case of malaria, although October–November is the most malarious period in this region. After a month, no Anopheline larvae were found, but a few Culicine larvae were present. After 6–7 weeks the bottom of the open channel below the packed section was covered with black sludge for several hundred yards, and the water was foul smelling and evidently entirely deprived of oxygen. In the uncleared bed of the stream above the packed section, *Anopheles maculatus*, Theo., and *A. fluviatilis*, James, were breeding normally, so that the smell from the adjacent section could have had no repellent effect. After 6 months, the toxic substances leached from the herbage were entirely exhausted and the

re-oxygenation of the water again permitted the breeding of Anophelines. To obviate the danger of breeding in newly treated sections, it was decided that Paris green should be blown into the packing for the first 14 days at the usual 5-day intervals.

In a second experiment the plant used was *Diospyros ebenum*, which is normally of economic importance and therefore not generally available. No Anopheline breeding was observed and the method was also effectively used to deal with stagnant loops of the main river to which a large amount of oil is usually applied.

The third experiment, in which a drain round a rice-field was packed in December, chiefly with *Terminalia tomentosa*, was not successful. Anopheline breeding was observed on several occasions, and on lifting the packing it was found that no rotting was occurring. The probable explanation was that the plants contained plenty of sap in October, shortly after the end of the rains, whereas they did not in December so that the leaves, having a much lower water content, did not decompose. In herbage-covered streams there appeared to be a definite "species succession" among mosquitos other than Anophelines, which is discussed. It is clear from these experiments that ovipositing mosquitos can penetrate the herbage cover in large numbers and the method appears to act by biological means rather than as a form of subsoil drainage [*cf.* **21** 254]. The saving effected by using this method instead of oiling is discussed. The author considers that it offers the first definite hope as a method of larval control suitable for use in villages, and advocates careful chemical and biological study of the treated water.

Chowdhury (K. L.). **Three Years' (1933 to 1935) Malaria Control Work in Calcutta.**—*Rec. Malar. Surv. India* **6** no. 3 pp. 467–481, 1 graph, 1 map, 8 refs. Calcutta, September 1936.

After quoting from Covell's report on a malaria survey of Calcutta carried out in 1932 in which he advocated a vigorous mosquito control campaign [*R.A.E.*, B **20** 195], the author describes the work of the Mosquito Control Department of the City Corporation. Cisterns and other receptacles for storing water will be necessary so long as no constant supply of water at high pressure is available in the City. As these constitute the chief breeding places of *Anopheles stephensi*, List., the principal vector of malaria, the most important measure against this mosquito is to render them mosquito-proof. The distribution of the other vectors, *A. sundaicus*, Rdnw., and *A. varuna*, Iyen., is localised [**23** 300]; any breeding places discovered are treated at weekly intervals with Paris green at the rate of 5 per cent. in soft-stone powder. Oil balls [*cf.* **23** 128] have proved effective in running water. A mixture of crude oil and kerosene (1 : 2) is also used against larvae and various sprays against adult mosquitos. Malaria surveys show that the spleen and parasite indices are decreasing, the figures for 1932, 1934 and 1935 being 1·73, 1·17 and 0·84, and 2·6, 1·03 and 0·64, respectively.

Paul (S. H.), Das (G. S.) & Roy (S. C.). **A brief preliminary Report of the Malaria Survey of Haltugaon in the District of Goalpara, Assam. (Abstract.)**—*Rec. Malar. Surv. India* **6** no. 3 pp. 483–485. Calcutta, September 1936.

A survey of a small forest settlement in Assam revealed 17 species of Anophelines, but among the adults dissected only those of *Anopheles*

minimus, Theo., were found to be infected with malaria parasites, the sporozoite and oöcyst rates both being 0·67 per cent. Breeding of this species took place chiefly at the extensive grassy edge of the small river that forms the eastern and southern boundaries of the area. It was not found in swamps or wells. The largest number of cases of malaria occurs annually in May, about a month after the onset of the rains. The measures recommended for the control of the larvae of *A. minimus* are the trimming of the banks of the river and the application of oil and Paris green.

Papers noticed by Title only.

Komp (W. H. W.) & Osorno M. (E.). **The Male and Larva of *Anopheles* (*Kerteszia*) *boliviensis* Theobald. (Diptera, Culicidae.)**—*Ann. ent. Soc. Amer.* **29** no. 3 pp. 415–419, 2 figs., 5 refs. Columbus, Ohio, September 1936.

Wu (Shih-cheng). **Further Notes on the Mosquitoes collected in a few famous Localities of Chekiang and Anhwei.**—*Ent. & Phytopath.* **4** no. 23 pp. 462–463. Hangchow, 11th August 1936. [*Cf. R.A.E.*, B **23** 306.]

Yao (Y. T.) & Wu (C. C.). **Some Abnormalities of the Morphology of the Male Hypopygia of *Anopheles hyrcanus* var. *sinensis* Wied., in Nanking.**—*Peking nat. Hist. Bull.* **11** pt. 1 pp. 27–34, 3 pls., 10 refs. Peiping, September 1936.

Mulligan (H. W.) & Puri (I. M.). ***Anopheles habibi* Mulligan and Puri 1936—a Correction** [of the original description].—*Rec. Malar. Surv. India* **6** no. 3 p. 513. Calcutta, September 1936. [*Cf. R.A.E.*, B **24** 167.]

Enderlein (G.). **Simuliologica i** [including descriptions of 5 new genera and 20 new species of Simuliids].—*S. B. Ges. naturf. Fr. Berl.* 1936 pp. 113–130. Berlin, 1936.

Philip (C. B.). **An interesting new Horsefly** [*Anacimas geropogon*] **from North Carolina (Diptera : Tabanidae).**—*Ent. News* **47** no. 9 pp. 229–231, 2 figs. Philadelphia, Pa, November 1936.

Wagner (J.). **The Fleas of British Columbia** [including 4 new species]. *Canad. Ent.* **68** no. 9 pp. 193–207, 10 figs., 40 refs. Orillia, Ont., September 1936.

Jordan (K.). **Two new Australian Fleas.** [*Xenopsylla vexabilis meseris*, subsp. n., and *Stivalius molestus*, sp. n., on rats.]—*Proc. Linn. Soc. N.S.W.* **61** pt. 3–4 pp. 184–185. Sydney, September 1936.

Schulze (P.). **Die Untergattung *Hyalommina* und die erste Art aus dem tropischen Afrika (Ixod.).** [The Subgenus *Hyalommina* and the first Species from Tropical Africa (*Hyalomma lewisi*, sp. n., from cattle in Tanganyika).]—*Zool. Anz.* **116** no. 9–10 pp. 258–264, 3 figs., 5 refs. Leipzig, 1st December 1936.

Hoffmann (C. C.) & Vargas (L.). **Contribuciones al conocimiento de los venenos de los alacranes mexicanos.** [Contributions to the Knowledge of the Poisons of Mexican Scorpions.]—*Bol. Inst. Hig. Mex.* **2** no. 4 pp. 182–193, 1 graph. Mexico, D.F., August 1935. [Recd. December 1936.] [*Cf. R.A.E.*, B **21** 72 ; **23** 208.]

Hoffmann (C. C.). **Algunas palabras acerca de las razas americanas del** ***Anopheles maculipennis*** **Meigen.** [Some Notes on the American Races of *A. maculipennis*.]—*Rev. Paras. Clín. Lab.* **2** no. 2 pp. 403–411. Havana, 1936. (With Summaries in French and English.)

In North America, *Anopheles maculipennis*, Mg., comprises at least two races, *occidentalis*, D. & K. [*cf. R.A.E.*, B **23** 235] and *aztecus*, Hffm. The latter occurs in Mexico, where it was for many years thought to be *A. quadrimaculatus*, Say [**23** 193]; Martini, who saw only two females, identified it as *A. atropos*, D. & K. [**23** 254], which does not occur in Mexico. The range of *occidentalis*, which is essentially a western and northern form, extends from California to Alaska on the west, across Canada on the north, and as far south as Maine and Massachusetts on the Atlantic coast. A list is given of the synonymy of both the American races.

In the author's opinion the various forms of *A. maculipennis* should be grouped as follows: *occidentalis* and *aztecus*; *maculipennis* (*typicus*), *messeae*, Flni., and *melanoon*, Hackett; *atroparvus*, van Thiel, and *labranchiae*, Flni.; and *A. sacharovi*, Favr (*elutus*, Edw.), which is not considered specifically distinct.

Knipling (E. F.). **A comparative Study of the first-instar Larvae of the Genus** ***Sarcophaga*** **(Calliphoridae, Diptera), with Notes on the Biology.**—*J. Parasit.* **22** no. 5 pp. 417–454, 91 figs., 11 refs. Baltimore, Md, October 1936.

This paper records a comparative study of the first larval instar of 24 viviparous species of *Sarcophaga* common in the United States, reared from gravid females collected in Illinois, Iowa and Texas. A review of the literature [*cf. R.A.E.*, B **18** 39; **16** 62; **13** 69; **11** 179] and specific descriptions of the larvae are given. Observations on larviposition and specific variations in it are described. Larvae were reared on decaying meats or cow or horse manure in jars partly filled with moist sand, covered with gauze or a 36-mesh copper screen, either in the laboratory or out-of-doors. Considerable variation in feeding habits was observed, even within a single species, but the species of the group allied to *S. prohibita*, Aldr., are apparently obligate parasites of insects or other animals, as attempts to rear them on several media proved unsuccessful. This group comprises several closely allied Sarcophagids having a distinct larvipositor and includes the Palaearctic species placed in *Blaesoxipha* by some workers. The duration of development to the adult stage is indicated for some species, and in the case of *S. stimulans*, Wlk., this was observed to occupy as little as 11 days, the larval stage taking only 4. During the latter part of September and October, larvae of several species pupated and then went into hibernation, the adults emerging in the late winter or early spring. Possibly all species of *Sarcophaga* overwinter as pupae in Iowa. Species were identified by means of the adult males reared, and a detailed study of larval characteristics was made. All species showed specific characteristics and some of them fell into distinct morphological groups.

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Atchley (F. O.) & Hull (J. B.). **Oviposition by *Culicoides* breeding in Salt Marshes.**—*J. Parasit.* **22** no. 5 p. 514. Baltimore, Md, October 1936.

This note describes a method used during studies of the species of *Culicoides* that breed in salt marshes on the south-east coast of the United States [*cf. R.A.E.*, B **22** 109], in order to obtain oviposition under laboratory conditions. Females of *C. canithorax*, Hffm., *C. dovei*, Hall, and *C. melleus*, Coq., were caught in the field and kept in glass chimneys closed at the upper end with gauze and resting on moist blotting paper or moist marsh soil in Petri dishes. A meal of human blood was given 12 hours after capture, and oviposition occurred 4–12 days later. Eggs singly and in masses of up to 30 were observed, an increased number of blood meals having no effect on oviposition. The females died before, during and after oviposition, and the ovaries of dead examples contained eggs. A few females that oviposited within 2 days of collection were assumed to have taken blood prior to capture. Some eggs hatched as early as 4–5 days after oviposition, both when kept on blotting paper moistened with distilled water and when placed in distilled water, but the larvae died within 24 hours, whereas larvae that hatched in salt marsh water lived for several days.

da Fonseca (F.). ***Flebotomus* das cercanias da cidade de S. Paulo, com a descripção de *Flebotomus arthuri* n. sp. e *alphabeticus* n. sp. (Dipt. Psychodidae).** [*Phlebotomus* from the Environs of the City of S. Paulo with a Description of *P. arthuri* and *P. alphabeticus*, spp. n.] —*Rev. Ent.* **6** no. 3–4 pp. 323–327, 9 figs., 1 ref. Rio de Janeiro, 30th October 1936.

The species of *Phlebotomus* taken near São Paulo were, in order of abundance, *P. arthuri*, sp. n., *P. fischeri*, Pinto, *P. limai*, Fonseca, *P. monticolus*, Costa Lima, and *P. alphabeticus*, sp. n. The two new species are described from females. Both *P. arthuri* and *P. fischeri* attacked man in the open and were attracted indoors by lights.

da Fonseca (F.). **Sobre o macho de *Tunga travassosi* Pinto et Dreyfus, 1927, e o parasitismo de *Euphractes sexcinctus* L. por *Tunga penetrans* (L., 1758) (Siph., Tungidae).** [On the Male of *T. travassosi* and the Parasitism of *E. sexcinctus* by *T. penetrans*.]—*Rev. Ent.* **6** no. 3–4 pp. 421–424, 6 figs., 2 refs. Rio de Janeiro, 30th October 1936.

Several male fleas of the genus *Tunga* were obtained from *Euphractes sexcinctus*, in São Paulo. One was *T. penetrans*, L., which has not previously been recorded from an armadillo. The others, which are described, are thought to be the hitherto unknown males of *T. travassosi*, Pinto & Dreyfus.

Townsend (C. H. T.). **On *Cochliomyia hominivorax* Coquerel (Dipt.).**—*Rev. Ent.* **6** no. 3–4 pp. 485–487. Rio de Janeiro, 30th October 1936.

Attention is drawn to the discovery that the species of *Cochliomyia* generally responsible for cases of myiasis in man and animals is *C. hominivorax*, Coq. (*americana*, Cushing & Patton) and not *C. macellaria*,

F. [*R.A.E.*, B **22** 45; **23** 11; **24** 101]. Characters are given distinguishing both sexes of the two species, and the significance of those defining the genus *Cochliomyia* are briefly discussed. The hypopygial terminology used by Patton [**22** 45, etc.] is criticised.

Hart (R. L. L.). **Annual Report of the Veterinary Department, Uganda, 1935.**—Fol. 20 pp. Entebbe, 1936.

Except in the Eastern Province and the Lango District of the Northern Province, trypanosomiasis is widespread among cattle in Uganda, and, although it is unusual for spectacular losses to occur at any one time, the losses in infected herds are heavy over long periods. It is believed that the disease is commonly transmitted directly by Tabanids or *Stomoxys*, and infection can seldom be traced to immediate contact with *Glossina*, even though such infection does sometimes occur. Cattle that have been in the neighbourhood of places known to be infested by *Glossina* have become infected, and an infected animal from such a herd, although it may not show clinical symptoms, is frequently the source of infection of an uninfected herd. Climatic conditions in Uganda are, on the whole, favourable to blood-sucking flies, and, once infection has been introduced, the disease spreads more or less rapidly, the rate apparently depending on the density of the flies. The wetter months of the year, in which there is an increase in vegetation, seem to be most favourable to the flies, and it is shortly after rainy periods that the disease is most evident. The areas where it is prevalent are given, together with the probable sources of infection. No adequate control can be expected in what may be termed enzootic areas until herds become smaller and are kept separate, and recently purchased animals are segregated.

G. morsitans, Westw., spread during 1935 into a new area in South Ankole [*cf. R.A.E.*, B **24** 2]. Apparently as a result of repeated disturbance by a poacher, game, accompanied by the flies, crossed a ridge 5,000 ft. high and descended into the plains on the far side. A certain number of these flies succeeded in establishing themselves within a short distance of a cattle trade route, and it is feared that further clearing will be necessary to protect the road and prevent further spread to the north. The situation regarding infestation by tsetse flies in other areas is briefly reviewed. In some places their numbers have decreased; in others they have disappeared, and it has been possible to re-introduce cattle with safety.

McCulloch (R. N.), Howe (K. R.) & Hockley (J.). **Jetting and Crutching for the Control of Blowfly Strike.**—*Agric. Gaz. N.S.W.* **47** pt. 9 pp. 486–490, 2 figs., 5 refs. Sydney, September 1936.

In continuation of experiments on crutching and jetting for protecting sheep from infestation by blowflies in New South Wales [*cf. R.A.E.*, B **24** 38], further tests were made during the season 1935–36 to ascertain the value of two jettings five weeks apart during each of the spring and autumn periods of fly activity, as compared with hand-dressing when necessary. The value of crutching on the advent of fly activity in the spring was also examined. Fly infestation during the season was normal.

The tests were made on a flock of 750 breeding ewes divided into three equal groups, of which one was jetted with calcium arsenite mixture

(10 : 10 : $1\frac{1}{4}$: 100) [*cf.* **22** 17] on 25th October, 27th November, 21st April and 29th May. A second group was crutched on 26th October, and the whole flock, including the third group, untreated except for hand-dressing, was crutched on 10th March. All strikes were dressed in the second and third groups, but only the severe ones in the first. From October to February, the numbers of strikes dressed in these groups were: jetted 8, crutched 1, untreated 133. For the full year the totals were 42, 95 and 254. Spring crutching and frequent hand-dressings both reduced the value of the breech wool, and crutching is considerably more expensive than jetting. Thus, for the control of strike only, jetting provided the most economical treatment. Lambing took place from 4th April to 18th May, and after the first autumn jetting was applied on 21st April, 10 jetted ewes were dressed as compared with 36 and 57 in the other groups. The jetted ewes reared 39 per cent. of lambs as compared with 53 and 46 per cent. in the other groups. If jetting reduced the lambing percentage, it seems probable that it was the treatment during mating rather than that during lambing that was responsible. The jetted sheep produced an average clip per head of 11 lb. 12 oz. of wool, compared with 10 lb. 1 oz. and 11 lb. 2 oz. from the other groups. Jetting caused no injury to the wool treated and was associated with a reduction in deaths from strike and in the number of "tender" fleeces shorn. The jetting programme employed, therefore, appears to have had a markedly beneficial, rather than an adverse, effect on wool production.

Hobson (R. P.). **Sheep Blow-fly Investigations. III. Observations on the Chemotropism of** *Lucilia sericata* **Mg.**—*Ann. appl. Biol.* **23** no. 4 pp. 845–851, 5 refs. Cambridge, November 1936. **IV. On the Chemistry of the Fleece with reference to the Susceptibility of Sheep to Blow-fly Attack.**—*T.c.* pp. 852–861, 5 refs.

Previous experiments showed that two factors are necessary to induce *Lucilia sericata*, Mg., to oviposit on living sheep [*cf. R.A.E.*, B **23** 227]; one is supplied by the sheep and is probably some volatile sweat constituent, and the other is a product of putrefaction. These factors are referred to as *S* and *P* respectively. The *S* factor was apparently absent from slaughtered animals. A preliminary investigation of the nature of the *P* factor showed that ammonia was attractive when placed on living sheep. Further experiments, described in the present paper, have been carried out to test the attractiveness of various chemicals when placed on sheep, and the value of other substances in preventing oviposition on sheep treated with an attractive substance. The method of testing consisted in pouring 5–10 ml. of the test solution on a piece of cotton wool tied to the fleece of a sheep and after 1–2 hours examining the treated spot for the presence of eggs. A positive control was carried out with a substance known to be attractive, usually larval excreta. To compare the attractiveness of different substances, a solution was diluted 2, 4, 8 or more times, until oviposition was no longer induced.

The *S* factor in an individual sheep appeared to be equally effective throughout the experiments, but in different sheep it showed marked variations. It is not an odour perceptible to man, but since it varied

from sheep to sheep and, in conjunction with the *P* factor, is effective from a distance, it is presumably a substance that attracts flies by its odour.

For accurate investigation of repellent action, a standard attractant is required, to which can be added the substances to be tested for effectiveness in preventing oviposition. In preliminary experiments no standard attractant was available and 5 ml. larval excreta was therefore used with 1·0 or 0·1 per cent. of the substance to be tested. The best results were obtained with pine tar oil, which was so strongly repellent that 0·1 per cent. prevented oviposition, and with mustard oil, phenol and camphor, which were repellent at 1 per cent. but not at 0·1. The results show that *L. sericata* is very persistent and cannot easily be prevented from depositing eggs. The method is a critical one and should be of value in eliminating useless repellents. When the weather is hot and sunny, three experiments can be carried out on one sheep in a day.

In further experiments to determine the nature of the *P* factor, ammonium carbonate proved far more attractive than ammonium hydroxide, but the effect of putrefying material is not due entirely to this compound, for larval excreta were attractive at a dilution containing an amount of ammonium carbonate that was in itself too small to be effective. The substances must be volatile, since evaporating excreta to dryness destroyed their attractiveness. Steam distillates of excreta did not prove highly attractive, so that the chemotropic effect is probably due to a mixture of moderately volatile compounds that only distil slowly with steam. As various aliphatic alcohols, acids and esters attract house-flies [*Musca domestica*, L.], tests were carried out with compounds of this nature and with certain putrefactive bases. It seemed possible that ammonium carbonate might be an essential component of the *P* factor, so in most of the experiments the substance to be tested was added to a solution of ammonium carbonate of half the minimum concentration that was attractive by itself. None of the aliphatic compounds proved highly attractive, but a solution of indole, prepared by dissolving it in a small amount of alcohol and then diluting the solution with water, was strongly attractive and induced oviposition on one sheep at a concentration as low as 0·005 per cent. Skatole (methyl indole) was also highly attractive. Both these substances are products of bacterial putrefaction and possess an obnoxious faecal odour. The attractant properties of mixtures of ammonium carbonate and indole appeared to be equal to, or slightly greater than, the sum of those of the components separately. Neither was attractive when not placed on sheep.

The attractiveness of sheep, which varies considerably among individuals, can now be measured by means of solutions of ammonium carbonate or indole. In tests on preventive measures, especially repellents, and on dressings for strikes, the ability to choose sheep of equal attractiveness should increase the probability of obtaining significant results.

In the second paper are given the results of analyses of wool of sheep undertaken to test the hypothesis of Holdaway & Mulhearn that the " sweat " content of a fleece provides an index to the susceptibility of sheep to blowfly attack [**22** 259]. In Britain, the rump and shoulder are the most common sites of strike, and, although soiling with urine and faeces explains the susceptibility of the rump, it is difficult to account for the attractiveness of the shoulder. If the theory

is correct, the amount of suint (water-soluble matter termed sweat in the paper cited) in the wool on the shoulder should be higher than in that on the rest of the back, which is less susceptible.

The pH value and the amounts of suint and grease were determined for samples of wool from different parts of the body of ewes and lambs. The results show that the suint content varies in a random way over the back, but is significantly higher on the flanks and breast. This difference may be partly due to the leaching effect of rain. The distribution of grease appears to be fairly even, except that the wool on the breast was found to contain less than that on the back and flanks. It was thought that the pH value might prove to be an indicator of susceptibility, since blowfly attack is usually associated with bacterial activity. The pH value varied with the suint content ; although the correlation was not statistically significant, a high pH value was always associated with a high suint content and conversely. In ewes, the reaction was approximately neutral on the back and alkaline on the flanks and breast ; in fat lambs, the reactions were more alkaline. The shoulder region did not show any marked differences from the other parts of the back. There was no significant difference in the suint or grease contents in struck and unstruck sheep.

These results do not support the hypothesis, as the suint content was lower on the back, including the more susceptible region, than on the breast and flanks. Other factors must, therefore, be responsible for the regional distribution of susceptibility. It is possible, however, that sheep having wool with a high suint content may be more susceptible.

The author points out that the hypothesis depended partly on indirect evidence, and no suint analyses were carried out to substantiate it. An examination of the argument on which the theory is based leads him to conclude that, without further work, the colour of the yolk cannot be regarded as a reliable measure of the amount of suint. On the other hand the suggestion that predisposition to weather stain and strike is correlated with yolk colour [**22** 260] appears to be supported by the observation that strike in Britain often seems to be associated with abnormal colouration of the fleece. It is doubtful, however, whether the discolourations observed are identical with the weather stain described for merino sheep in Australia.

McGovran (E. R.) & Ellisor (L. O.). **Repellency of Pine-tar Oil to wound-infesting Blowflies.**—*J. econ. Ent.* **29** no. 5 pp. 980–983, 2 refs. Menasha, Wis., October 1936.

A serious outbreak of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) occurred in the south-eastern part of the United States in 1933–35 [*cf. R.A.E.*, B **23** 200 ; **24** 4], and investigations were undertaken in Georgia in 1935 to determine the most effective means of control. As previous experiments had shown that pine-tar oil is the most practical repellent, because it is effective, cheap, readily available, harmless to animals, and very adhesive [*cf.* **14** 165 ; **15** 194], tests were carried out during August–November in which wounds on the hips of goats and sheep that had previously been infested with *C. hominivorax* were treated with this material (specific gravity 1·065) at intervals of 1–5 days. The wounds were about 1½ ins. wide by 2½ ins. long by 1½ ins. deep and 3–6 cc. of the pine-tar oil was applied with a brush to the open surface and a strip 1–2 ins. wide around it. The six groups of animals, which included one untreated group, were exposed

continuously under natural conditions. Reasonably accurate determinations were made of the numbers of egg-masses deposited by *C. hominivorax*, and the numbers of egg-masses or batches of larvae deposited by secondary blowflies, which comprised chiefly *C. macellaria*, F., and species of *Phormia*, *Lucilia* and *Sarcophaga*, were estimated. The average numbers of infestations per animal per day were 0·01, 0·07, 0·13, 0·18 and 0·18 in animals treated at intervals of 1, 2, 3, 4 and 5 days, respectively, and 0·27 in untreated animals.

FENTON (F. A.) & BIEBERDORF (G. A.). **Fly Control on A & M Farms, Stillwater, Okla.**—*J. econ. Ent.* **29** no. 5 pp. 1003–1008, 2 graphs, 2 refs. Menasha, Wis., October 1936.

The large collection of farm buildings and of numbers of domestic animals and poultry that is connected with the school of agriculture of the Oklahoma A. & M. College has led to the breeding of enormous numbers of flies that are troublesome not only at the College but also in the adjacent residential district of Stillwater. An account is given of a campaign undertaken in 1935 to reduce the nuisance ; its success was indicated by the fact that flies were not nearly so numerous in the city area as they were in 1934, when the season had been less favourable for breeding, and trapping was discontinued at several points early in the season because so few flies were being caught.

Steps were taken to ensure the proper disposal of manure, and within a short time the standing manure piles had been removed and each day's collection was being dealt with within 24 hours. Manure that could not be removed was treated with hellebore or borax. Hellebore was tried because it does not render the manure toxic to plants, but when used at a strength of ½ lb. to 10 U.S. gals. water for the treatment of 8 bushels manure it proved ineffective in both field and laboratory tests. Borax was therefore substituted whenever the manure was not to be used as a fertiliser. It was not satisfactory as a spray because a large amount was needed for a small amount of manure, but it was effective when liberally applied to the manure as a powder and afterwards sprayed with water. Fly traps were used in the barns. Of the baits tested, the most attractive consisted of 3¼ lb. wheat bran, 1¾ lb. lucerne meal, 2 cakes yeast, 5 U.S. qts. water, 25 cc. Diamalt [a malt syrup] and 1 U.S. qt. molasses. The bait was only effective when kept moist, and during the peak of the fly season, the traps were examined every day and water was added to the bait. The traps were emptied and the bait changed 2 or 3 times a week. The flies caught were measured by volume, 1 U.S. pint being equivalent to about 8,500 flies. Approximately 9,786,000 flies were taken in the 24 traps. Of the flies in 51 sample lots examined, 93·8 per cent. were *Musca domestica*, L., and 68·72 per cent. of these were females. A spray of 1 gal. of a proprietary pyrethrum extract to 20 gals. water-white kerosene was also used in the barns, and whenever it was applied more or less regularly, the fly population as indicated by the traps fell considerably. The traps were supplemented by pans of a poison bait consisting of 1 U.S. pt. milk, 1 U.S. pt. water, ½ oz. molasses and 2–3 teaspoonfuls 40 per cent. formaldehyde, which killed large numbers of flies.

The average number of flies caught per trap reached its maximum between 21st and 24th June (25,500), after which, although wide fluctuations were observed, it gradually decreased, particularly from

15th July. Probably as the result of the cooler weather and higher humidity that occurred after 29th August, there was an increase in the numbers caught later in the season, and on 15th October the average reached 13,430. This increase was also due in part to the general relaxation of other control measures during the period when the flies were scarce.

Twinn (C. R.). **The Blackflies of eastern Canada (Simuliidae, Diptera). Parts I–II.**—*Canad. J. Res.* (D) **14** nos. 9–10 pp. 97–150, 15 figs., 58 refs. Ottawa, September–October 1936.

This paper includes 23 species and 1 variety belonging to 3 subgenera of *Simulium*. The variety and 12 of the species are new. Of the remaining 11 species, only 2 have been recorded previously in Eastern Canada, and 2 are recorded in North America for the first time. The treatment followed throughout is essentially taxonomic. The adults, pupae and cocoons are described, the genitalia of both sexes are figured, and notes are included on habitats, distribution, species associations and similar information of value in segregating and determining the species. Keys are given to the subgenera and species, including both sexes of the adults and the pupae.

[Rubtzov (I. A.).] **Рубцов (И. А.) Data on the Biology and Ecology of Simuliidae.** [*In Russian.*]—*Bull. Inst. sci. Biol. Geogr. Univ. Irkoutsk* **6** no. 2–4 pp. 109–133. Moscow, 1935. [Recd. 1936.]

The relation between meteorological conditions and the behaviour of Simuliids was studied in June–August 1932 in the western part of East Siberia. Laboratory experiments were made to determine the optimum temperatures for the larvae and adults of the two most common species, *Simulium ornatum*, Mg., and *S. morsitans*, Edw., and the maximum and minimum temperatures limiting their activity, the period of exposure being 10 minutes in all cases. The larvae became torpid at temperatures between 0 and −3°C. [32–26·6°F.] or 33 and 39°C. [91·4–102·2°F.]; some died between −3 and −5°C. [26·6–23°F.] or 40 and 44°C. [104–111·2°F.], and all died between −6 and −13°C. [21·2–8·6°F.] or 45 and 46°C. [113–114·8°F.]. They were slightly active at 1°C. [33·8°F.] and normally active at 7–16°C. [44·6–60·8°F.], about 12°C. [53·6°F.] being the optimum; above 18°C. [64·4°F.] they again became less active. In experiments with the adults (engorged or unfed), at a relative humidity of 60–70 per cent., torpor occurred between −1 and −4°C. [30·2–24·8°F.] or 37 and 39°C. [98·6–112·2°F.], activity was normal at 10–26°C. [50–78·8°F.], the optimum being about 20°C. [68°F.], and death occurred at 40°C. [104°F.]. These experiments indicate that the larvae would not be killed if the water froze for a short period and the temperature did not drop below −3°C. [26·6°F.], and that the threshold of development is at about 5°C. [41°F.].

Field observations showed that the rapidity with which the larvae develop varies in the same stream, depending on the temperature of the water. The eggs only hatch where the water temperature is not below 4·5°C. [40·1°F.]. Different species of Simuliids require different temperatures for development, and some are more adaptable than others. At a mean summer temperature of the water of 5–7°C. [41–44·6°F.], several species have one generation a year, the adults

emerging in late July or early August. Most of the more common species, however, such as *S. ornatum*, *S. morsitans*, *S. venustum*, Say, and *S. aureum*, Fries, prefer water having a temperature of 8–10°C. [46·4–50°F.] and produce two generations a year; the adults are present throughout July and in early August, and the mature larvae of the second generation hibernate. A few species breed in waters with a temperature of 15°C. [59°F.] and sometimes even of 25–27°C. [77–80·6°F.], and have three generations a year, the adults emerging at the end of May, beginning of July and beginning of September, and the young larvae hibernating and completing their development in spring. In this way, a river with the temperature varying from the source to the mouth may harbour a series of different species of Simuliids.

The activity of the adults was found to depend chiefly on the temperature of the air and to a less extent on relative humidity and wind. It was greatest at a temperature of 20–22°C. [68–71·6°F.] and a humidity of 70–75 per cent., and in the absence of wind. Simuliids cause most annoyance in dull cloudy weather, probably owing to the usually increased humidity and temperature. Light rain accelerates their activity, which fluctuates in inverse proportion to the barometric pressure, increasing as the barometer drops.

In western Europe, Simuliids chiefly occur in river valleys and are practically absent at altitudes above 650 ft. (which has led to the suggestion that they are specific to low-lying places), but in eastern Siberia they are most abundant on ridges at a height of 330–650 ft. in places that have been partly cleared from forests. They migrate from the valleys to higher altitudes for pairing, and, after a week or more, return to the breeding places for oviposition. They do not occur, however, on very high open mountain ridges and watersheds. Their migration from the place of emergence to a higher altitude may be explained by the inversion of temperature, which is usual in eastern Siberia but practically does not occur in Europe. It is particularly apparent in winter and in dull rainy weather, but also often occurs in the summer. The inversion increases in the absence of wind, and in calm sunny weather the temperature in some places rises by 1°C. [1·8°F.] or more with each 30 ft. of ascent. As a result, the Simuliids move to higher altitudes where they find the optimum temperature conditions. The migrations are also stimulated by the increased humidity and shelter from the wind that are available in the small woods on the ridges of the hills.

DAMPF (A.). **Les Cératopogonidés agents transmetteurs de filaires.**—*Bull. Off. int. Hyg. publ.* **28** no. 10 pp. 1955–1960, 7 refs. Paris, October 1936.

Though *Onchocerca cervicalis* is apparently transmitted by *Culicoides nubeculosus*, Mg. [*cf. R.A.E.*, B **22** 58; **24** 197], the only known vectors of the species of *Onchocerca* that infest man are Simuliids. Investigations on their possible transmission by *Culicoides* were carried out in 1935 in the Chiapas coffee district of Mexico, where onchocercosis [due to *O. caecutiens*] is prevalent [*cf. R.A.E.*, B **20** 113, etc.]. Dissections were made of 107 midges, apparently of a single species of *Culicoides*, collected from children on a coffee plantation, and microfilariae were found in the thoracic muscles of 3 individuals, 4 in each, but none in the head, buccal organs, abdominal cavity or stomach. The dimensions of the microfilariae are given; those in one of the midges

were large, corresponding to those of *O. caecutiens*, while those in the others were small and apparently belong to some other species.

The species of *Culicoides* observed in the Chiapas district apparently develops in damp spots and was observed in greatest numbers near cattle. It is attracted by artificial light, and its period of greatest activity is at sunset.

RILEY (W. A.). **The Tropical, or Oriental, Rat Flea,** *Xenopsylla cheopis* **established in Minnesota.**—*J. Lancet* **56** no. 11 pp. 591–592. Minneapolis, Minn., November 1936.

OWEN (W. B.). **An Infestation by the Oriental Rat Flea,** *Xenopsylla cheopis* **Rothschild, in Minnesota.**—*J. Parasit.* **22** no. 5 pp. 512–513. Lancaster, Pa, October 1936.

It has been supposed that the distribution of *Xenopsylla cheopis*, Roths., in the United States is limited to sea-ports, and that it would not become established in areas where long periods of frost occur. These two papers record an infestation in St. Paul, Minnesota. In July 1936, fleas causing considerable annoyance to workers were collected from the floor and hay in a barn and also from cats that had been introduced to control an infestation of rats, and were identified as *X. cheopis*. The first paper includes instances from the literature indicating that *X. cheopis* is established not only in ports, notably New Orleans [*cf. R.A.E.*, B **14** 3], but also in the north-central United States (Indiana [**13** 71] and Iowa [**22** 164]), and the author gives an account of a further examination in St. Paul of 45 rats taken from two widely separated rubbish dumps, which yielded 370 examples of *X. cheopis*. This evidence suggests that the introduction of a plague-infected rodent might cause the spread of infection in both rats and man. A number of foci of infection already exist in the United States [*cf.* **25** 7].

Plague Infection in Fleas taken from Ground Squirrels in San Bernardino County, Calif.—*Publ. Hlth Rep.* **51** no. 42 p. 1445. Washington, D.C., 16th October 1936.

A further communication from C. R. Eskey [*cf. R.A.E.*, B **25** 7] records the discovery of plague-infected fleas on ground squirrels (*Citellus beechyi fisheri*) in San Bernardino County, California, in August 1936. One case of positive plague agglutination of the blood in man was recorded, but a search for plague-infected rodents proved unsuccessful. A suspected case of plague in man was investigated in the same county in 1933, but no infected rodents were found.

LEWTHWAITE (R.), HODGKIN (E. P.) & SAVOOR (S. R.). **The Typhus Group of Diseases in Malaya. Part VI. The Search for Carriers.**—*Brit. J. exp. Path.* **17** pp. 309–317, 9 refs. London, 1936.

The greater part of the information contained in this paper on the possible vectors of the types of tropical typhus in Malaya has already been noticed from other sources [*R.A.E.*, B **24** 29, 261]. After the successful transmission of the urban type of tropical typhus by examples of *Xenopsylla cheopis*, Roths., transferred from infected to healthy rats [**24** 262], all the fleas were removed from the box. During the next 9 days only larvae were seen. Batches of adult fleas were obtained

on the 10th and 11th days ; these were ground up in saline and the respective suspensions were each inoculated into two guineapigs, none of which reacted. Thus the progeny of infected fleas proved to be free from infection.

Covell (G.) & Mehta (D. R.). **Studies on Typhus in the Simla Hills. Part VI. The Rôle of the Human Body-louse in the Transmission of Typhus.**—*Indian J. med. Res.* **24** no. 2 pp. 389–397, 1 pl., 3 charts, 10 refs. Calcutta, October 1936.

It has been suggested that the transmission of typhus from man to man by means of *Pediculus humanus*, L., may explain the epidemics that occur from time to time in the Simla Hills area [*cf. R.A.E.*, B **24** 105], and the experiments here described were designed to throw light on this question.

The following is mainly taken from the authors' summary : Attempts were made to transmit a strain of typhus, originally derived from the brains of wild rats, from monkey to monkey by means of the human body-louse. The technique of feeding and dissecting the lice is described. Of 60 lice fed on experimentally infected monkeys, 3 showed enormous numbers of bipolar-staining rickettsiae in smears from the mid-gut. Of 3 monkeys on which lice from the infected batch were allowed to feed, one developed a febrile reaction and another a slight rise in agglutinins for *Proteus* OX 19. A guineapig subpassaged from the former animal gave a febrile reaction but no scrotal reaction. Lice that had died during the experiment were rubbed into the scarified skin of a fourth monkey, which developed a febrile reaction, together with a slight rise in agglutinins for *Proteus* OX 19. Guineapigs subpassaged from this animal have shown pyrexia, but no scrotal reaction.

Although the attempt to infect lice was successful, the results of the experiments on the transmission of the virus from monkey to monkey by means of lice are considered to be inconclusive.

Smith (R. O. A.), Mukerjee (S.) & Chiranji Lal. **Bionomics of *P. argentipes*. Part II. The Breeding Sites of *P. argentipes* and an Attempt to control these Insects by Anti-larval Measures.**—*Indian J. med. Res.* **24** no. 2 pp. 557–562, 1 ref. Calcutta, October 1936.

A study of the breeding places of *Phlebotomus argentipes*, Ann. & Brun., was carried out in 1933 and 1934, mainly in two villages near Calcutta. Records were kept of the numbers of adults found in houses, and samples of soil from probable breeding places were examined for larvae by the method advocated by Young, Richmond & Brendish [*R.A.E.*, B **14** 147]. In addition to *P. argentipes*, the species taken were *P. papatasii*, Scop., *P. shortti*, Adl. & Thdr., *P. squamipleuris*, Newst., and *P. babu*, Ann. The preference of *P. argentipes* for cattle blood and of *P. papatasii* for human blood was clearly indicated by the fact that the former was most numerous in cattle sheds and the latter in dwellings. Few sandflies were taken during the winter, but their numbers rapidly increased with the advent of warm weather and remained fairly high until the following cold season.

The larvae were identified by the position and nature of the hairy spines on the head and body. *P. shortti* and *P. babu* were often associated with *P. argentipes* in breeding grounds, but *P. papatasii*

was not. Practically every sample of soil that contained larvae of *P. argentipes* was collected within 20 yards of a dwelling or cattle-shed. The breeding sites varied with the seasons. During dry weather the larvae were often found near the sides of reservoirs, in soil sheltered from the sun by thick vegetation, whereas during the rains they were taken closer to houses, beside the plinths protected by the eaves, and often inside houses and cattle-sheds. The soil samples containing most larvae were taken during or just after the monsoon ; during the dry months, when the area suitable for larvae was greater, small numbers of larvae were taken in a relatively large number of samples. Better results were obtained by collecting loose earth to a depth of 3–4 inches over a wide area than by digging deeper into the firmer soil in a limited one. Few larvae were found in soil that was firm on top, even though there were cracks on the surface. Breeding did not occur in rat-holes, which were apparently used as shelters only by the adults ; in urban areas, however, where the floors are paved and the area of unprotected soil is less, breeding often took place in them. In general, there was no correlation between the number of adults taken in a given site and the number of larvae collected from soil in the vicinity. Larger numbers of sandfly larvae were found in samples containing few or no larvae of other insects.

Spraying breeding sites and surrounding areas with Necrosene (1 : 150) or with a mixture of crude oil and kerosene against the larvae was ineffective, and it is concluded that in rural areas spraying or fumigation against the adults would probably give more satisfactory results.

Swynnerton (C. F. M.). **The Tsetse Flies of East Africa. A first Study of their Ecology, with a View to their Control. With a Preface by the Right Hon. W. Ormsby-Gore, M.P.**—*Trans. R. ent. Soc. Lond.* **84** xxxvi + 579 + [29] pp., 23 pls., 33 figs., 7 maps. London, November 1936. Price £5 10*s*.

In this work, a comprehensive account is given of the present state of knowledge in regard to the ecology and control of tsetse flies (*Glossina*) in East Africa. It covers mainly the work of the Tsetse Research Department, Tanganyika Territory, carried out from January 1931 to December 1934, but also includes a number of observations made outside this period and area, a history of the work, and a comparison of old methods with new ones.

The paper is divided into 13 parts under the following headings : Introductory, Financial and Administrative (pp. 1–27) ; The Investigation of the Habits and Ecology of Tsetse Flies as a means for devising their Destruction (pp. 28–240) ; Experimentation in Attack (pp. 241–296), which includes information on natural enemies, trapping, modifications of vegetation forming cover, control of food supplies, etc. ; Observation and Experimentation directed to the Production of an absolute Fly Barrier (pp. 297–329), in which the means of dispersal of the fly are outlined and the types of barriers that may be used to prevent its spread are discussed ; Survey (pp. 330–356), in which surveys and reconnaissances carried out on foot, by car and by aeroplane are described ; Reclamation and Settlement, Water Supply, and some Reclamation Techniques (pp. 357–423), which includes details of clearings that have been or will be made, and of the various methods used ; Defence against Fly Advances (pp. 424–438), in which

the history of the spread in various areas, the present position and the measures recommended are reviewed ; Co-operation with British and Foreign Territories and with Authorities in the Tanganyika Territory (pp. 439–456) ; Other Matters of Interest (pp. 457–465), in which various unrelated subjects, such as experiments on keeping and working cattle in fly areas, the botanical work that has been done, etc., are discussed ; Acknowledgments (pp. 466–468) ; Discussion of the Prospects and Needs of the Work (pp. 469–472) ; General Summary (pp. 473–511) ; and Concluding Note (p. 512), in which the work that has so far been accomplished is very briefly summarised and the permanent need for an expert entomological organisation to plan and direct the application of methods of control evolved is emphasised.

The 10 appendices include : The Use of the " Recovery Index " in estimating the true Density of Tsetse Flies, by C. H. N. Jackson ; A Summary of some of the Results of J. D. Scott's Ecological Investigation at Kikore ; A preliminary List of some east African Mammals, with an Indication of their possible Relation to Tsetse Flies, by C. F. M. and G. H. Swynnerton ; A List of Plants referred to in the present Paper, with some Native Names, by B. D. Burtt ; Some Details of the Experiments in poisoning Savanna and Rain-Forest Trees and Thicket, by S. Napier-Bax ; and A Note on the Distinctive Characters of the east African Species of the genus *Glossina* Wiedemann, 1830, and of their Pupae, specially prepared for Use by Workers in the Field, by C. F. M. Swynnerton.

BEVAN (L. E. W.). **The Tsetse-fly Disease.**—*Rhod. agric. J.* **33** no. 10, pp. 746–769, 4 pls., 6 figs. Salisbury, S. Rhodesia, October 1936.

After dealing first with trypanosomes in general and then with the species occurring in man and animals in Southern Rhodesia, the author discusses the work that has been done on immunity and on treatment, and concludes with a review of the present position regarding trypanosomiasis in central Africa.

STEWART (J. L.). **Porcine Trypanosomiasis in the Gold Coast.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 3 pp. 313–314, 2 refs. London, 28th November 1936.

The author describes an outbreak of acute, rapidly fatal trypanosomiasis due to *Trypanosoma simiae* [*cf. R.A.E.*, B **24** 143] that occurred in June 1936 near Kumasi among pigs on a farm in the Ashanti rain forest ; *Glossina palpalis*, R.-D., was common round the farm. This is the first time that *T. simiae* has been definitely identified from West Africa. Trypanosomiasis has only recently been diagnosed in pigs in the Gold Coast, and brief notes are therefore given on infections, due to *T. brucei* in the Northern Territories [**23** 201] and to *T. congolense* in the Colony.

KLIGLER (I. J.) & COMAROFF (R.). **An Epidemic Outbreak of Murine Typhus in a Labour Group in an Inland Village in Palestine.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 3 pp. 363–368, 9 refs. London, 28th November 1936.

An account is given of an outbreak of typhus in a village in the Jordan Valley, 60 miles from the coast, during 1936. The epidemic

occurred in spring (March–June), the incidence was higher among men than women, the cases were clinically mild, no lice [*Pediculus humanus*, L.] were present, and rats were abundant. Infection was demonstrated in wild rats and their fleas by inoculations and subinoculations into guineapigs and rats. The mildness of the disease in man, the frequency of infection in rats (it occurred in at least 4 out of 11 examined), and the presence of the virus in fleas, all suggest that the epidemic was caused by the virus from rats; moreover, the extensive scrotal swelling produced in subinoculated guineapigs and the infectivity for rats differentiated the virus from that transmitted by lice.

[Schilling (C.) & Roubaud (E.).] **Au sujet des modes divers de l'évolution trypanosomienne chez les glossines.**—*Bull. Soc. Path. exot.* **29** no. 8 pp. 817–820. Paris, 1936.

In a letter to Roubaud (written as a result of reading his paper on atypical trypanosome infections in *Glossina* [*R.A.E.*, B **23** 264]), Schilling puts forward a theory to account for the different situations occupied by the three different groups of trypanosomes [**13** 64] in the body of the fly. He considers that it is a question of the particular medium to which the trypanosomes are able to adapt themselves. In newly emerged flies that have not fed, the labial cavity contains bubbles of air separated by a clear liquid that is probably saliva secreted before emergence. Some hours after a fly has sucked blood, clear serum containing hardly any red corpuscles is seen in the proboscis. In the intervals between blood meals, it probably mixes with the saliva issuing from the point of the hypopharynx in a continuous stream, and also, by diffusion, with the contents of the pharynx and even of the proventriculus. Blood entering at the lower end of the proboscis becomes mixed with this liquid, and it is thought to be the composition of this mixture that determines the fate of the ingested trypanosomes. Those that are unable to adapt themselves to it die. Saliva is not a usual medium for flagellates, and when it is too concentrated they find it impossible to adapt themselves to it, and the fly does not become infected. The trypanosomes of the group of *Trypanosoma vivax* adapt themselves most easily to the mixture of serum and saliva; they develop in it in the proboscis and hypopharynx, but do not ascend to the salivary glands, where the saliva is pure, nor to the pharynx. If they enter the crop or oesophagus, they die. Trypanosomes of the *congolense* group also adapt themselves easily to the saliva-serum mixture and may remain in it. They may, however, develop in the intestine, but this is evidently not the normal habitat and so of no importance in their evolutionary cycle. It is questionable whether it is necessary to presume a development in the pharynx and proventriculus and a migration back to the proboscis, since it seems possible that a small quantity of saliva may enter the proximal parts of the intestine and there promote the development of cyclic forms, which make their way back to the labial cavity. Trypanosomes of the *brucei* group complete their development in the pure saliva in the salivary glands and hypopharynx. It is improbable that they arrive in these situations by penetrating through the intestinal wall and the abdominal and thoracic cavity. It seems more likely that certain rare trypanosomes enter the hypopharynx directly, ascend the salivary current and establish themselves in the central canal of the gland. The others make their way into the intestines, but their development

there is primitive and aberrant. When the adaptation of the trypanosomes is finished, whether in the intestine or in the saliva, the cyclic or metacyclic flagellates may diminish in numbers or disappear, but they always remain longest in the saliva or a mixture containing saliva, which indicates that, once adaptation has occurred, the saliva is the best medium for these forms. If parasites are found only in the intestine, as has been observed to be the case with old laboratory strains, then the trypanosomes of the strains studied are not able or are no longer able to adapt themselves to saliva. If metacyclic forms are found in the pharynx or proventriculus, it may be that saliva has entered these organs during or after a meal. The main point seems to be that wherever metacyclic forms are found, saliva is always present in the medium because a certain amount of this fluid is necessary for their formation.

In his reply, Roubaud states that he agrees with Schilling's suggestions.

RODHAIN (J.). **Piroplasmes d'okapi et d'éléphants dans l'Ouelle.**—*Bull. Soc. Path. exot.* **29** no. 8 pp. 877–881, 1 fig., 9 refs. Paris, 1936.

Nuttallia loxodontis, sp. n., is described from the blood of an elephant in Bas Uele, Belgian Congo, and as examples of *Amblyomma tholloni*, Neum., and *Dermacentor circumguttatus*, Neum., were taken on the animal, it is suggested that one of them may be the vector.

ROUBAUD (E.), TREILLARD (M.) & TOUMANOFF (C.). **Nouvelles expériences d'intercroisement de biotypes chez l'***Anopheles maculipennis*.—*Bull. Soc. Path. exot.* **29** no. 8 pp. 898–901, 3 figs., 6 refs. Paris, 1936.

In view of the reported sterility of the progeny that resulted when races of *Anopheles maculipennis*, Mg., belonging to the group containing *messeae*, Flni., and the typical race *maculipennis* were crossed with those belonging to the group containing *atroparvus*, van Theil, and *labranchiae*, Flni. [*cf. R.A.E.*, B **22** 199; **23** 115; etc.], the authors undertook experiments in which attempts were made to cross the typical race with *cambournaci*, Roub. [*cf.* **25** 2]. When males of *cambournaci* were placed in a small cage (about 24 × 16 × 16 ins.) with females of the typical race, no fertilisation took place, but when males of the typical race were placed in a cage of the same size with females of *cambournaci*, fertile progeny was obtained and three hybrid generations have already been reared. In the eggs of the first hybrid generation, the characters of *cambournaci* were predominant, although in this and the following generation a few eggs showed characters more nearly approaching those of the typical race.

GIBBINS (E. G.). **On a melanic inland Race of** *Anopheles costalis* **Giles** (*gambiae*) **in Uganda.**—*Ann. trop. Med. Parasit.* **30** no. 3 pp. 275–282, 1 fig., 11 refs. Liverpool, 21st October 1936.

The author records observations on an inland race of *Anopheles gambiae*, Giles (*costalis*, auct) in Uganda, which showed melanic pigmentation but was not associated with brackish water [*cf. R.A.E.*, B **20** 64, 65]. The following is largely taken from his summary: Melanism was most marked in the adults that were bred from larvae taken in peaty water. When kept in their original breeding water and

given artificial food (powdered yeast), the melanic larvae lost most of their dark pigmentation. The larvae of the melanic race can be easily distinguished from normal *gambiae* by the striking pigmentation of the fronto-clypeus, which appears to conform to a regular pattern and does not seem to alter even if the larva subsequently loses the rest of its dark pigment. Individual larvae showing the characteristic fronto-clypeus of the melanic race may occur amongst normal examples from typical *gambiae* breeding places. When reared from this type of habitat where food is abundant, the adults do not exhibit melanic pigmentation. From a comparison of the chemical constituents of the waters from which normal and melanic larvae were taken, it is clear that the melanic tendencies are not due to salinity or the presence of dissolved iron ; it would appear to be a question of the type of food available.

PATTON (W. S.). **Studies on the Higher Diptera of Medical and Veterinary Importance. A Revision of the Species of the Genus *Glossina* Wiedemann based on a comparative Study of the Male and Female Terminalia.**—*Ann. trop. Med. Parasit.* **30** no. 3 pp. 305–330, 25 figs., 20 refs. Liverpool, 21st October 1936.

This paper, which concludes the series, deals in the same manner as previous ones [*R.A.E.*, B **24** 171, 277] with *Glossina pallidipes*, Aust., *G. longipalpis*, Wied., *G. austeni*, Newst., *G. palpalis*, R.-D., *G. palpalis* var. *fuscipes*, Newst., *G. palpalis* var. *wellmani*, Aust., *G. tachinoides*, Westw., *G. pallicera*, Big., *G. caliginea*, Aust., and *G. newsteadi*, Aust. Before discussing the species of the *palpalis* group, the author points out that it is necessary, after dissection in Canada balsam, to mount the male terminalia on slides without compression and to orientate them all in the same way in order to get uniform results when illustrating them. He also describes the characters of the terminalia of the group. As the result of a study of the forms of *G. palpalis*, he concludes that the form found in the northern, central and parts of the western regions of the Belgian Congo should be considered the typical one, and that the eastern forms, which include *martinii*, Zumpt [*cf.* **24** 309, etc.], should be regarded as a single variety, *G. palpalis* var. *fuscipes* and the western form as *G. papalis* var. *wellmani*.

NICHOLLS (L.). **Framboesia tropica—a short Review of a Colonial Report concerning Statistics and** *Hippelates flavipes*.—*Ann. trop. Med. Parasit.* **30** no. 3 pp. 331–335, 1 graph, 2 refs. Liverpool, 21st October 1936.

Yaws, at one time a very prevalent disease in the West Indies, is now disappearing, owing to the discovery of effective treatment, and the asylums in which patients used to be segregated have been closed. As it is unlikely that many records of the past have been preserved, the author gives a summary of statistics for St. Lucia covering the period 1882–1910 and recorded by him in a report published in 1911, together with a few of the conclusions drawn from them. In the report, a description was given of a small Oscinid, which was called the " ulcer fly," later identified as *Hippelates pallipes*, Lw. (*flavipes*, Lw.), and of its habits. It was stated that the majority of cases of framboesia (the granulomatous eruption of yaws) were believed to be caused by this fly inoculating surface injuries [*cf.* *R.A.E.*, B **24**

219, etc.]. It was also suggested that the spread of yaws in St. Lucia depended principally on nakedness, which renders persons liable to small injuries and abrasions, and to the presence of the fly.

SYMES (C. B.). *Anopheles funestus* **(Giles) as a "Domestic Breeder."**—*Ann. trop. Med. Parasit.* **30** no. 3 pp. 361–364. Liverpool, 21st October 1936.

Observations on the breeding habits of *Anopheles funestus*, Giles, have been made in a small town on the east coast of Kenya at various times since 1927. From the available records, there appeared to be little seasonal fluctuation in the incidence of malaria, which is prevalent. This suggested that *Anopheles gambiae*, Giles, was not the important vector, since its density in other parts of Kenya usually varies with the rainfall, and, in fact, breeding places of this species appeared to be scarce even in the wet season, though the larvae were occasionally found in wells and more rarely in domestic water containers. Larvae of *A. funestus*, on the other hand, were consistently taken in domestic water containers of all kinds and in wells. Many of those in containers had undoubtedly been brought in from wells, but where water is stored in quantity for indefinite periods, it is almost certain that breeding occurs actually in the houses. A small local fish, *Tilapia mozambicus*, is being used to reduce infestation in wells and tanks. In dwellings, all water containing larvae is thrown away or oiled.

MERRETT (W. E. S.). **A brief Review of recent Trends in Yellow Fever Research.**—*W. Afr. med. J.* **9** no. 1 pp. 2–9, 38 refs. Lagos, October 1936.

This paper includes a section (pp. 3–4) on the occurrence of yellow fever in the absence of *Aëdes aegypti*, L., much of the information in which has already been noticed [*cf. R.A.E.*, B **24** 34, etc.]. The author states that an outbreak of yellow fever has recently occurred in the interior of Brazil, where *A. aegypti* is not present, and that it could not be prevented from spreading towards the São Paulo area because the nature of the intervening terrain precluded mosquito control.

BROWN (J. Y.). **Observed Infestation of Culicine Mosquitos by larval Hydrachnids in Nigeria.**—*W. Afr. med. J.* **9** no. 1 p. 20. Lagos, October 1936.

In Nigeria, infestation of adult mosquitos by mites is fairly common. The author has observed it in species of *Culex* and *Anopheles*, and, most often, in *Mansonia* (*Mansonioides*) *africana*, Theo. The mites appeared to be in the larval stage, but the mode of infestation was not known. In the course of a short mosquito survey at Kano, pupae of *Culex* (?) *annulioris*, Theo., were collected from one margin of a small pond that was almost entirely covered with green algae, and some of the adults obtained from them were infested with larval Hydrachnids. Mosquito larvae collected at the same time were allowed to pupate, and gave rise to uninfested adults. In no instances in nature were the larvae found to be infested, but many heavily infested pupae were found. When the mites were detached from the pupae and placed with them in a container, they regained their hold in a short time. In a further experiment, 6 mites recovered from the

pond-water were placed in a container with a larva and 2 uninfested pupae of *C.* (?) *annulioris* and a larva of *Anopheles gambiae*, Giles (*costalis*, auct.). The lateral position of the Anopheline larva rendered it liable to attack by the mites, but it shook them off. The Culicine larva was not attacked, and both it and the Anopheline gave rise to uninfested adults. The two Culicine pupae were infested, as were the adults that emerged from them. While attached to the pupae, the mites did not develop much, but when attached to the adult mosquitos, they increased considerably in size within a few hours.

Collignon (E.). **La campagne antipaludique de 1935 en Algérie (partie orientale du département d'Alger et département de Constantine).**—*Arch. Inst. Pasteur Algér.* **14** no. 3 pp. 391–406, 9 pls. Algiers, 1936.

Gouget (R.). **La campagne antipaludique de 1935 dans le département d'Oran et l'ouest du département d'Alger.**—*T.c.* pp. 407–412.

An account is given of the work carried out against Anophelines and malaria in Algeria during 1935, which followed the same lines as that in previous years [*cf.* *R.A.E.*, B **24** 12]. Observations were made on the breeding places of the larvae and the diurnal resting places of the adults. The rainfall during the year was less than normal. The spring rains, which were heavier than usual in April and May, swept out the few spring breeding places, and, since they occurred at a time when the rate of evaporation was already high, did not create persistent breeding places. In certain regions, breeding places in the water courses were destroyed by storms in late June and early September. The density of Anophelines was comparatively low, but larvae of *Anopheles maculipennis*, Mg., persisted throughout the season. The decrease in the activity of the adults, which was marked by their disappearance from diurnal shelters, did not apparently affect oviposition, as evidenced by collections of larvae in July, August and September. The apparent decrease in numbers of adults coincided with rises in temperature and great variations in the degree of humidity in July and August [*cf.* **24** 312].

Missiroli (A.). **Sullo sviluppo dei parassiti malarici.** [The Development of Malaria Parasites.]—*Riv. Malariol.* (1) **13** fasc. 5 pp. 539–552, 4 figs., 2 pls., 12 refs. Rome, 1934. (With a Summary in English.)

Knowles (R.) & Basu (B. C.). **Nuclear Division in malarial Sporozoites.**—*Indian J. med. Res.* **22** no. 3 pp. 443–447, 1 fig., 1 pl., 9 refs. Calcutta, January 1935.

De Meillon (B.). **Nuclear Division in Sporozoites of** ***Plasmodium.***—*S. Afr. med. J.* **10** p. 474, 1 fig., 2 refs. Cape Town, July 1936.

These three papers record observations on the nuclear division of sporozoites of *Plasmodium* spp. The first includes an account of studies made in Italy in 1933–34 to test the hypothesis that malaria sporozoites, being organisms adapted to the tissues of mosquitos, must undergo biological and morphological changes if they are to survive in warm-blooded animals. Experiments in which birds were inoculated with sporozoites of *Plasmodium praecox* (*relictum*) showed that the sporozoites begin to disappear from the site of inoculation within 5 minutes, that they undergo division, and that it is probably

small parts resulting from this division that infect the red blood corpuscles. A subsidiary experiment carried out by Ferreira showed that, 12–14 days after sucking blood from sparrows infected with *P. praecox*, females of *Culex* had sporozoites in their salivary glands, and many of these were observed to contain 2–8 granules symmetrically arranged in the centre.

The second paper deals with observations made in India in 1934 during experiments on *Anopheles stephensi*, List. Films made from infected salivary glands of this Anopheline repeatedly showed *P. vivax* and *P. falciparum* in various stages of nuclear division, sometimes with 2 or 3 separate nuclei.

The third paper records findings in South Africa during routine dissections of mosquitos in the laboratory. These were performed in distilled water rather than saline, as in it the sporozoites swell up and are more easily visible. For several years it had been observed that not all sporozoites swell in this manner. Recently, sporozoites in a gland from *A. funestus*, Giles, that did not swell were observed to contain several small nuclei distributed almost throughout their length, whereas swollen sporozoites had either only one nucleus or several congregated in the middle. Some unswollen sporozoites contained only about 4 nuclei, but others a large number. It thus appears that the sporozoites undergo development while still in the mosquito, and it is suggested that this development may be necessary for infection of the vertebrate host to result. Some of the cases in which infection has not followed inoculation may have been due to the fact that the sporozoites were immature, the nuclei not having divided.

Kostić (D. J.). **The Extent to which Zoophilism can be taken into Consideration as regards Anopheline Mosquitoes of S. Serbia (812 haemoprecipitin Tests in determining the Source of Blood in Stomachs of 812** *Anopheles* **of South Serbia).** [*In Serbian.*]—*Glasn. tzentr. khig. Zavoda* **19** no. 2 pp. 153–164, 7 refs. Belgrade, 1936. (With a Summary in English.)

Of the species of *Anopheles* that occur in southern Serbia, *A. maculipennis*, Mg., is the most widely distributed, the races present being *maculipennis* (*typicus*) and *messeae*, Flni. [*cf. R.A.E.*, B **22** 118; **24** 161]. The others, in descending order of abundance, are *A. superpictus*, Grassi, the numbers of which vary greatly in different years, *A. claviger*, Mg. (*bifurcatus*, auct.), which is widely distributed but present in small numbers only, *A. hyrcanus* var. *sinensis*, Wied., which is scarce, and *A. plumbeus*, Steph. (*nigripes*, Staeg.), which is restricted to wild surroundings. Malaria is found wherever Anophelines occur, and its prevalence varies with their abundance.

From 30th July to 15th October 1935, precipitin tests were made to ascertain the food-preferences of *A. superpictus* and *A. maculipennis*. In the case of mosquitos taken in inhabited houses, the percentages that had fed on man only, animals only and both were, respectively, 45·6, 40·8 and 13·6 for *A. maculipennis*, and 48·1, 21·5 and 34·4 for *A. superpictus*. The corresponding figures for mosquitos taken in animal quarters were 15·4, 76·7 and 7·9 for *A. maculipennis*, and 42·9, 44·7 and 12·4 for *A. superpictus*. The females of both species showed a tendency to attack man or animals even when they were completely engorged and so had no need to satisfy hunger.

Rossi (G.). **Come Maccarese potè bonificarsi integralmente nonostante la malaria.** [How Maccarese was fully reclaimed in Spite of Malaria.]—*Ann. R. Ist. sup. agrar. Portici* (3) **7** pp. 163–379, 15 figs., 41 pls., 11 pp. refs. Portici, 1935. [Recd. January 1937.]

This is an account of the various branches of reclamation work carried out on an estate of about 11,000 acres on the sea coast north of the mouth of the Tiber, where malaria had been rife in the past. A notable reduction in the incidence of the disease has been effected, but it cannot be completely eliminated until the adjoining malarious districts have been improved. Measures against Anophelines included stocking all waters with *Gambusia*; cleaning canals and ditches, this being supplemented in a few special cases by dusting with Paris green; and the screening of houses and the use in them of fly-sprays, one of which was made locally on a large scale from pyrethrum grown on the estate.

[Ul'yanishchev (V. I.) & Rifling (E. A.).] **Ульянищев (В. И.) и Рифлинг (Е. А.). A new Preparation "Oleoarsenite" for Control of Mosquito Larvae.** [*In Russian.*]—In *Summary sci. Res. Work Inst. Plant Prot. 1935* pp. 473–475. Leningrad, Lenin Acad. agric. Sci., 1936.

Of various waste products of the oil-refining industry tested in the Azov-Black Sea Region as carriers for Paris green against Anopheline larvae, the best was oleogumbrin. This is a black powder, the particles of which average 15·85 microns; it has a specific gravity of 0·7 and contains 10 per cent. of waste oil, which prevents it from being wetted and keeps it on the surface of the water as a thin film for a period of over 10 days. The addition of 4 parts oleogumbrin to 1 part Paris green decreased by from 20 to 50 per cent. the amount of Paris green required for a given area of water. In large scale trials, in which nearly 160 sq. miles of water surface were dusted, the mixture invariably gave 100 per cent. mortality of Anopheline larvae. To obtain a larvicide cheaper than Paris green, however, oleogumbrin was tested in combination with a calcium arsenite insoluble in water, but soluble in weak acids. A 1 : 4 mixture, which was named oleoarsenite, killed all Anopheline larvae in 5–10 hours when used in the laboratory, and was applied in the field with equally successful results, a water surface of about 60 sq. miles being dusted with it in the autumn of 1934. The preparation of the mixture is very simple, it floats well and costs much less than any larvicide containing Paris green.

Hodgkin (E. P.) & Johnston (R. S.). **Malaria at Batu Gajah, Perak: Transmitted by** *Anopheles barbirostris* **Van der Wulp.**—*Bull. Inst. med. Res. F.M.S.* no. 1 of 1935, 19 pp., 3 pls., 9 refs. Kuala Lumpur, 1935. [Recd. December 1936.]

This account of investigations into the transmission of malaria by *Anopheles barbirostris*, Wulp, in Batu Gajah, Perak, contains much information that has already been noticed [*R.A.E.*, B **23** 61, 273; **24** 30]. A considerable increase in the incidence of malaria, with an increased proportion of benign tertian [*Plasmodium vivax*], in the absence of the usual Malayan vectors, was observed in 1933, and in 1934 fresh malaria cases amounted to 2·5 per cent. of the population. As a result of the dissection of mosquitos caught in the town, it is shown

that *A. barbirostris* is a sufficiently good vector of malaria to be able to maintain the disease in an endemic form. A few other instances of its infection in Malaya and Sumatra are reviewed. It is also suspected of having been the vector in a relatively bad outbreak in Krian, north Perak, in 1934, where it was very numerous, and of transmitting the disease at Butterworth, Province Wellesley, where infected examples have recently been found. In Batu Gajah, it breeds in the swamps close to the town, and the apparent disparity between the numbers of larvae and adults found [**24** 30] is probably due to the difficulty of surveying the swamp areas, even by boat, owing to the rank vegetation covering parts of them. Precipitin tests indicated that it prefers human blood to that of cattle [**23** 60]. A list of control measures adopted is given, these being principally directed to draining and filling up the swamps.

The conditions favouring the transmission of malaria at Batu Gajah appear to be very similar to those under which *A. hyrcanus* var. *sinensis*, Wied., and var. *nigerrimus*, Giles, were found carrying infection in Kuala Lumpur in 1931 [**20** 276 ; **21** 192]. In both cases there was a dense human population, large numbers of mosquitos in an area in which stream-breeding Anophelines were controlled, and relatively few domestic animals. At Batu Gajah, however, the area affected was greater than at Kuala Lumpur and malaria was more prevalent. *A. barbirostris* was found only in small numbers at the time of the Kuala Lumpur outbreak ; on the other hand, both races of *A. hyrcanus* were present in considerable numbers at Batu Gajah and yet were apparently not vectors of importance.

Trager (W.). **The Utilization of Solutes by Mosquito Larvae.**—*Biol. Bull.* **71** no. 2 pp. 343–352, 1 fig., 22 refs. Lancaster, Pa, October 1936.

An account is given of experiments made with *Aëdes aegypti*, L., demonstrating that mosquito larvae can utilise solutes in true solution [*cf. R.A.E.*, B **18** 233 ; **19** 25 ; **20** 173]. The results are summarised as follows : The larvae require for development at a normal rate a proper concentration of calcium chloride, known to exist in water as a solute. Their growth is likewise conditioned by an organic growth factor shown to be also a solute. Finally, the larvae can develop at least as far as the fourth instar in media the nutrients of which exist entirely in true solution.

Williamson (K. B.). **The Soil in Relation to Malaria.**—7 pp., 23 refs. Singapore, League of Nations Eastern Bureau, 1936.

The author discusses the influence of soil on malaria incidence and Anopheline breeding, with examples from India and Malaya. In many cases, prevalence of Anophelines and malaria is correlated with a low nitrogen content of the soil [*cf. R.A.E.*, B **16** 69, 203]. The chemical nature of the soil affects its content of living organisms [*cf.* **25** 3] and also the water in which Anopheline larvae develop, particularly if this water is shallow and stagnant. The character of the water at the mouth of a river is very different from that at its source, as the deposition of rich alluvium washed down from the land through which it flows causes an accumulation of organic compounds. A very small change in the nitrogen content of soils, which is mainly in the form of organic compounds, is sufficient to affect bacteria, and

hence Anopheline development. A table is given showing the relation between soils with varying nitrogen contents and malaria incidence, spleen rates falling from over 70 per cent. in the Punjab, where the total nitrogen content of the soil is 0·047 per cent., to 1·9 per cent. in Krian, F.M.S., where it varies from 0·209 to 0·639. In conformity with these observations, the breeding of *A. culicifacies*, Giles, a species that avoids more than a bare minimum of organic matter, might be prevented in Ceylon by the method of "herbage cover" [*cf.* **23** 130; **25** 46].

Almost all Anophelines dissected in a part of Penang with a light-cropping sandy soil have been found infected with malaria parasites, except *A. vagus*, Dön., which usually breeds in muddy water with a high ammonia content, and is then not a natural vector. *A. vagus*, however, has been reported as the sole vector of malaria in a locality on one bank of the Black River in Indo-China, where the soil is sandy. Further, *A. gambiae*, Giles (*costalis*, auct.), an important vector in South Africa, where the parched soils north of Cape Colony cannot be rich in organic matter, breeds in muddy but otherwise uncontaminated puddles. In the Sudan, where the nitrogen content of the soil is under 0·1 per cent., irrigation is said to create malaria. From this evidence, it is concluded that, on soils with a nitrogen content of less than 0·1 per cent., more or less intense "flat land" malaria is to be expected from standing surface water, and that Anophelines bred from it are likely to prove efficient malaria vectors, irrespective of their species, but with local variations. With nitrogen contents much above 0·3 per cent., stagnant shallow waters are inimical to all Anopheline breeding, and even at considerably lower contents, breeding is inhibited by soil rich in organic matter, where solutes are concentrated and chemically reducing conditions obtain. Species that adapt themselves to contents slightly lower than 0·3 per cent. appear to possess little power of transmission, but are able to develop full effectiveness below 0·1 per cent. This explains both the freedom of coastal rice belts in the tropics from malaria [*cf.* **23** 130], and also the high rate of malaria in narrow upland valleys in Malaya, where organic silt is constantly washed down to the lower ground. In one case, the nitrogen content of the soil at the head of a valley was 0·049 per cent., and at the lower end 0·196 per cent.

Various explanations of the effect of nitrogen concentrations in the soil on the prevalence of Anophelines and malaria are suggested [*cf.* **16** 69, 203], and also that the ability of potential vectors to transmit malaria might be destroyed by enriching the organic nitrogen content of the soil to a less extent than would be necessary to eliminate the mosquitos themselves. In this connection, local variations are to be expected. Purity or otherwise of food must, over a long period, affect physiological characteristics and ability to transmit malaria, and may be a contributory cause of the development of localised races. Assuming that mosquitos have acquired the ability to act as intermediate hosts of blood parasites through ingestion and digestion of bacterially uncontaminated blood, Anophelines should be best adapted for transmitting malaria when their larval food and the environment and drinking water of the adults are least contaminated with bacteria, especially putrefactive bacteria and their products, which are absent from blood. This suggests the further possibility that Culicines that breed in pure water, such as *Culex bitaeniorhynchus*, Giles, may also be constitutionally adapted to serve as vectors of malaria.

DE JESUS (P. I.). **Physicochemical Factors in Anopheline Ecology, I: Studies on Nitrogen.**—*Philipp. J. Sci.* **59** no. 4 pp. 473–491, 24 refs. Manila, April 1936. [Recd. November 1936.]

This paper constitutes a preliminary report on investigations in Manila on physical and chemical factors affecting the breeding of *Anopheles minimus* var. *flavirostris*, Ludl., the chief vector of malaria in the Philippines [*cf. R.A.E.*, B **20** 235], and the associated Anophelines that breed in moving water, and includes findings on the nitrogen content of typical natural breeding places. The literature on the physicochemical factors affecting mosquito larvae is reviewed [*cf.* **10** 25; **14** 33, 85; **16** 203; **17** 86, 116; **18** 33, 34; **21** 147], and a typical breeding place of *A. minimus* var. *flavirostris* is described. This was a creek in Luzon that was small, sluggish and tortuous, its width, depth and discharge greatly increasing in the rainy season. Its banks, which were steep in some places, were covered with vegetation, notably the grass *Paspalum conjugatum*, which overhung the water, thus affording shelter for larvae. The bed of the creek was of sand or gravel, covered, in places frequented by water buffalo, with a thin layer of mud. No control measures were used on it during observations. Collections of larvae were made, and samples of water taken weekly for three months and later fortnightly from this creek, and a few from breeding places in other parts of Luzon for comparison, were filtered, investigated in the laboratory and analysed for turbidity and their contents of ammonia and albuminoid nitrogen, nitrate and nitrite nitrogen, chloride, total iron, dissolved oxygen and carbon dioxide. The results of 170 analyses, which are tabulated, show the number of observations and the frequency of occurrence of *A. minimus* var. *flavirostris*, *A. barbirostris*, Wulp, *A. aconitus*, Dön., *A. vagus*, Dön., *A. annularis*, Wulp (*fuliginosus*, Giles), and unidentified species in relation to increasing concentrations of the various nitrogen compounds, and also the seasonal variation of these in typical breeding places. *A. minimus* var. *flavirostris* occurred most frequently in concentrations of ammonia nitrogen of less than 0·025–0·124 parts per million, of albuminoid nitrogen of 0·050–0·349 p.p.m., of nitrite nitrogen of 0·0–0·079 p.p.m., and of nitrate nitrogen of 0·01–0·049 p.p.m., but these figures are by no means toleration limits. The author's general conclusion on this portion of the work is that *A. minimus* var. *flavirostris* breeds in water, notably streams, with low concentrations of nitrogen, characteristic of unpolluted natural surface water.

DEL ROSARIO (F.). *Dirofilaria immitis* **Leidy and its Culicine Intermediate Hosts in Manila, I.**—*Philipp. J. Sci.* **60** no. 1 pp. 45–57, 1 pl., 6 refs. Manila, May 1936.

Dogs in Manila are infected with *Filaria* (*Dirofilaria*) *immitis*, but nothing is known of its local vectors. The author describes experiments in which females of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) and *Aëdes aegypti*, L. (*Stegomyia fasciata*, F.), reared from larvae collected in Manila, were dissected at intervals after they had fed on an infected dog. About 73 per cent. of each species became infected. In *C. fatigans*, the migration of the microfilariae from the stomach to the Malpighian tubes was accomplished in about 12 hours from the time of feeding, the larvae took at least 5 days to become sausage-shaped, the whole development was completed in 10–12 days, and the

infective stage in the labium was noted in 11–13 days [*cf.* *R.A.E.*, B **19** 30]. In *A. aegypti* the infective stage was found 11 days after the blood meal.

PAPERS NOTICED BY TITLE ONLY.

NEWMAN (L. J.) & SHAW (G. D.). **The Stickfast Flea** *Echidnophaga gallinacea* **(Westwood) and Methods of Control** [on fowls in W. Australia].—*J. Dep. Agric. W. Aust.* (2) **13** no. 3 pp. 324–328, 4 figs. Perth, W.A., September 1936. [*Cf.* *R.A.E.*, B **13** 102, etc.]

LIU (Chi-ying). **Catalogue of Chinese Siphonaptera.**—*Lingnan Sci. J.* **15** nos. 3–4 pp. 379–390, 583–594. Canton, 1936.

CHANG (T. L.) & CHEU (S. P.). **Comparative Notes on the larval Characters of** *Culex pipiens* **var.** *pallens* **Coquillet and** *Culex fatigans* **Wiedemann.**—*Lingnan Sci. J.* **15** no. 4 pp. 613–626, 11 figs., 11 refs. Canton, 17th November 1936.

HWANG (N.). **A preliminary List of Chinese Tabanidae.**—*Ent. & Phytopath.* **4** no. 31 pp. 612–615. Hangchow, 1st November 1936.

ROWE (J. A.) & KNOWLTON (G. F.). **Pangoniinae of Utah (Tabanidae : Diptera).**—*Ohio J. Sci.* **36** no. 5 pp. 253–258, 1 pl. Colombus, Ohio, September 1936.

ROUDABUSH (R. L.). **Arthropod and Helminth Parasites of the American Bison** (*Bison bison*) [in Oklahoma, including *Dermacentor nigrolineatus*, Pack., and *Hypoderma lineatum*, Vill.]—*J. Parasit.* **22** no. 5 pp. 517–518. Lancaster, Pa, October 1936.

EVANS (A. C.). **The Physiology of the Sheep Blow-Fly** *Lucilia sericata* **Meig. (Diptera)** [a review of the literature].—*Trans. R. ent. Soc. Lond.* **85** pt. 15 pp. 363–377, 41 refs. London, 20th November 1936.

PATTON (W. S.) & WAINWRIGHT (C. J.). **The British Species of the Sub-family Sarcophaginae, with Illustrations of the Male and Female Terminalia.** [Part IV.]—*Ann. trop. Med. Parasit.* **30** no. 2 pp. 337–350, 8 figs. Liverpool, 21st October 1936. [*cf.* *R.A.E.*, B **24** 248.]

SOKOLOV (N. P.) & CHVALIOVA (M. A.). **Nutrition of** *Gambusia affinis* [*patruelis*] **on the Rice Fields of Turkestan** [including notes on its use against Anopheline larvae].—*J. Anim. Ecol.* **5** no. 2 pp. 390–395, 5 diagr., 12 refs. Cambridge, November 1936. [*Cf.* *R.A.E.*, B **25** 32.]

DUKE (H. L.). **Recent Observations on the Biology of the Trypanosomes of Man in Africa** [review of information followed by discussion].—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 3 pp. 275–308, 42 refs. London, 28th November 1936.

SERGENT (Edm.), DONATIEN (A.), PARROT (L.) & LESTOQUARD (F.).—**Cycle évolutif de** *Theileria dispar* **du boeuf chez la tique** *Hyalomma mauritanicum*.—*Arch. Inst. Pasteur Algér.* **14** no. 3 pp. 259–294, 1 col. pl., 10 figs., 38 refs. Algiers, 1936. [For briefer account see *R.A.E.*, B **24** 246.]

THOMPSON (T. O.). **Mosquito Destruction by James' Method.**—*J. R. Army med. Cps* **67** no. 5 pp. 331–335, 5 figs. London, November 1936.

A description with illustrations is given of the trap used in conjunction with pyrethrum fumigation [*R.A.E.*, B **23** 281] to destroy mosquitos in barracks in India.

DOZIER (H. L.). **Observations on Breeding Places and Winter Activities of Mosquitoes in the Vicinity of New Orleans, Louisiana.**—*Proc. ent. Soc. Wash.* **38** no. 7 pp. 148–155, 4 figs. Washington, D.C., October 1936.

During the winter of 1933–34, observations were carried out on the mosquitos inhabiting the swampy land lying to the east of New Orleans, Lousiana, for a distance of 5 to 10 miles. The two malaria vectors, *Anopheles quadrimaculatus*, Say, and *A. crucians*, Wied., were abundant over the entire area. Drainage operations were begun on 18th December, and from that time frequent routine collections of larvae and pupae were made in various types of breeding places within a short distance of selected catching stations established throughout the area. Fifteen species of mosquitos were identified ; in addition to the two Anophelines, *Culex salinarius*, Coq., *C. territans*, Wlk., *C. fatigans*, Wied. (*quinquefasciatus*, auct.), *Theobaldia inornata*, Will., and *Aëdes vexans*, Mg., proved to be widely distributed and abundant. Brief descriptions are given of some of the more important breeding places. Breeding seems to be continuous throughout the winter, at least during a mild one such as that under consideration. Larvae of all instars and pupae were found throughout the period December to March, inclusive. Larvae of *Anopheles crucians*, from the third instar to those fully grown, and pupae were found in abundance, together with larvae of *C. salinarius*, *C. fatigans* and *T. inornata*, when the temperature was 29°F. and the edges of the ponds were coated with ice. *A. crucians*, of which both the inland and coastal forms were present [*cf. R.A.E.*, B **13** 20 ; **20** 123], was the predominant winter Anopheline ; *A. punctipennis*, Say, was only reared on one occasion. Notes are given on the breeding places of the more important species.

KOMP (W. H. W.). *Anopheles* (*Anopheles*) *chiriquiensis*, **a new Species of** *Anopheles* **from Panama (Diptera, Culicidae).**—*Proc. ent. Soc. Wash.* **38** no. 7 pp. 156–160, 3 figs. Washington, D.C., October 1936.

Descriptions are given of the adults of both sexes and larva of *Anopheles* (*Anopheles*) *chiriquiensis*, sp. n., taken in the region of the Chiriqui volcano in the north-west of the Republic of Panama at an altitude of about 6,500 ft. The adults were found in hollow trees and under stream banks, and the larvae in a cold spring among rocks, where the temperature was about 57°F. As the habitat of the species appears to be restricted and the temperatures of the region are low, it is considered unlikely that it is a vector of malaria.

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Komp (W. H. W.). *Anopheles* (*Nyssorhynchus*) *anomalophyllus*, **a new Species of** ***Anopheles*** **from Panama and Costa Rica (Dipt., Culicidae).**—*Proc. ent. Soc. Wash.* **38** no. 7 pp. 160–164, 1 fig., 2 refs. Washington, D.C., October 1936.

The male and larva of *Anopheles* (*Nyssorhynchus*) *anomalophyllus*, sp. n., are described from Costa Rica and the Republic of Panama. The males were at first thought to be those of *A. tarsimaculatus*, Goeldi, but the larvae were found in streams, which are not the breeding place of this species, and further examination revealed differences in the male terminalia.

Knowlton (G. F.) & Rowe (J. A.). **Mosquito Studies.**—*Proc. Utah Acad. Sci.* **13** pp. 283–287, 1 fig. Provo, Utah, 1936.

Records are given of a few mosquitos, including *Anopheles maculipennis*, Mg., collected in Utah, together with brief notes on the rearing of *Theobaldia inornata*, Will., in the laboratory, and on the methods employed in handling mosquitos for experiments on the transmission of equine encephalomyelitis [*cf. R.A.E.*, B **24** 8].

Weyer (F.). **Versuche zur Uebertragung der Affenmalaria durch Stechmücken.** [Experiments in the Transmission by Mosquitos of Malaria in Monkeys.]—*Arch. Schiffs- u. Tropenhyg.* **41** no. 1 pp. 167–172, 4 figs. Leipzig, January 1937.

In experiments in Hamburg, German strains of *Anopheles maculipennis* var. *atroparvus*, van Thiel, and var. *messeae*, Flni., were infected with *Plasmodium cynomolgi*, *P. inui* and *P. knowlesi* by feeding on monkeys. Only one mosquito (out of 48) was infected with *P. inui*, one normal and mature cyst being found. With *P. cynomolgi* and *P. knowlesi* cysts and sporozoites were found in a considerable percentage of the mosquitos.

Attempts to infect monkeys by means of mosquitos or by injection of infected salivary glands were unsuccessful, except for two doubtful cases.

Ledentu (G.) & Peltier (M.) **Les maladies transmissibles observées dans les colonies françaises et territoires sous mandat pendant l'année 1934.**—*Ann. Méd. Pharm. colon.* **34** no. 3 pp. 474–749. Paris, 1936.

In the course of this comprehensive review of the situations regarding various diseases in the French Colonies and territories under French mandate during 1934, brief notes are given on the vectors of those transmitted by insects.

At Dakar, the percentages of the different species of fleas among 7,197 from rodents and 3,181 from the earth floors of huts were, respectively: *Xenopsylla cheopis*, Roths., 75·95 and 1·1, *Echidnophaga gallinacea*, Westw., 12·85 and 18·4, *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., 4·45 and 0·35, and *Synosternus pallidus*, Tasch., 6·75 and 80·15. A total of 101,890 fleas was taken on 36,006 rats. The control measures included spraying the floors of huts [*cf. R.A.E.* B **20** 202] and the rat-proofing of buildings.

From 1929, the incidence of plague in Senegal declined until 1933, when there were only 10 cases, but a sudden and severe outbreak occurred in three localities in 1934, and 583 cases were diagnosed between the second half of March and the end of November. No epizootic was reported among rats until May, but fleas had been extremely abundant in all three districts during the winter, when the rainfall was low. *Synosternus pallidus* predominated. The usual control measures were applied.

In Madagascar, a survey of the fleas on rodents, domestic animals and man, and in houses was undertaken in 1934, and 84,000 examples were caught between March and December. It was concluded that *X. cheopis* is found wherever plague is present even though its numbers may be small, and since it is ubiquitous there is no region that is not liable to an epidemic. *Synopsyllus fonquernii*, Wagn. & Roub., is almost as widely distributed as *X. cheopis*, and in some districts it is the predominant flea on rats. It is sometimes very abundant in the burrows of rats, even those in dwellings, and has been found in huts even when it was not present in rats' nests in them. *Dinopsyllus lypusus*, J. & R., was identified in one locality. It was found that cats harbour few fleas and never of the species that transmit plague, so that they may be used to control rats.

[SYMES (C. B.) & ROBERTS (J. I.).] **Section of Entomology.**—*Rep. med. Res. Lab. Kenya 1935* pp. 17–20. Nairobi, 1936.

The situation with regard to Anophelines and malaria in various parts of Kenya in 1935 is very briefly reviewed. *Anopheles demeilloni*, Evans, was found in huts in the Meru district [*cf. R.A.E.*, B **24** 102]. Searches for insects in aeroplanes are being continued [*cf.* **24** 66]; two examples of *Aëdes*, *A. nigeriensis*, Theo., and *A. argenteopunctatus*, Theo., were taken. It is thought that aeroplanes will cease to carry insects and rats only when thorough measures have been take to rid aerodromes of such pests. Brief notes are given on the clearings that are being made on the Kuja River and its tributaries and on the shore of Lake Victoria to eliminate *Glossina palpalis*, R.-D. [*cf.* **24** 87].

An intensive investigation of the area in south Kenya where plague is endemic has been continued. There is no evidence that field rodents constitute a reservoir in this area, or that the disease is transported by man, rats, fleas or merchandise to other areas [*cf.* **24** 65]. In towns in Kenya the flea population of domestic rats is mixed, whereas in native reserves only *Xenopsylla brasiliensis*, Baker, is present, and mortality in man is lower than in towns. It has now been established that rats living underground are only infested with *X. cheopis*, Roths., whereas those living in roofs, such as the thatched roofs of native huts, or even under corrugated iron structures, harbour *X. brasiliensis*. In towns, Africans and Indians have their bedding mainly on the floor, and contact with *X. cheopis* from rats emerging from the ground is greater than with *X. brasiliensis* from rats in roofs, especially as the latter often emerge only on the outside of the hut to raid cereal stores. Rat destruction on a large scale throughout endemic areas is at present too expensive, but fumigation during outbreaks would help to prevent contact between infected rats and man and is economically practicable.

There is now little doubt that the tropical typhus of Kenya is identical with Marseilles fever and is transmitted by *Rhipicephalus sanguineus*, Latr. [*cf.* **23** 262]. There are still a number of houses reported

as heavily infested with this tick, and apparently the only effective means of treating them is to strip all woodwork and to flame it and the walls with a blow-lamp.

Mazza (S.) & others. **Investigaciones sobre la enfermedad de Chagas. I–II.** [Investigations on Chagas' Disease. I–II.]—*Publ. Misión Estud. Pat. reg. argent. Jujuy* no. 29, 21 pp., 9 figs., 5 refs. Buenos Aires, 1936.

In a recent paper [*R.A.E.*, B **24** 248], Neiva & Lent considered *Triatoma rosenbuschi*, Mazza [**24** 137] to be a synonym of *T. platensis*, Neiva. Mazza disagrees with this view and compares the morphological characters of the two species.

In the second paper, the occurrence of *T. platensis* in birds' nests in Córdoba and Mendoza, Argentina, is recorded and also its experimental infection with *Trypanosoma* (*Schizotrypanum*) *cruzi* and the fact that a starving female engorged on a dog, thus showing its ability to adapt itself to an unusual host.

Kaston (B. J.). **The Distribution of Black Widow Spiders.**—*Science* **85** no. 2194, p. 74, 15 refs. New York, 15th January 1937.

A list is given from the literature of all the States from which *Latrodectus mactans*, F., has been recorded in the United States, and first records for Connecticut and Vermont are included.

Mosing (H.). **Une nouvelle infection à** *Rickettsia, Rickettsia weigli* **nov. sp.**—*Arch. Inst. Pasteur Tunis* **25** no. 3–4 pp. 373–387, 2 pls., 8 figs. Tunis, November 1936.

A detailed account is given of the results of nearly two years' investigations on the disease that broke out in September 1934 among workers at the Institute of Biology of Lwow [*cf. R.A.E.*, B **23** 257]. The extra-cellular type of *Rickettsia* that was found in the excreta or intestines of lice [*Pediculus humanus*, L.] that had fed on infected persons or had received an intrarectal injection of their blood is here described as *Rickettsia weigli*, sp. n. The rickettsiae develop and multiply in the lumen of the intestine, forming a regular layer on the surface of the epithelial membrane ; they are not injurious to the lice and were not transmitted during pairing or to progeny. They develop in lice kept at 30–36°C. [86–96·8°F.], but not in those kept at ordinary temperatures, and they die at 55°C. [131°F.] ; on the other hand, they retain their vitality at low temperatures, and transmission from louse to louse by intrarectal injections has been successful after the infected lice have been maintained for a month in a refrigerator. The close relation between the disease and the rickettsia is discussed. The origin of the first case is difficult to explain, but the others had all been in contact with infected lice. The seriousness of the symptoms do not appear to be correlated with the concentration of the virus in the peripheral blood, for 60–100 per cent. of the lice fed on abortive cases became infected. The blood remained infective for long periods after the clinical symptoms had disappeared, infection occurring in 3–5 per cent. of the lice fed after 2 months, and in 1–3 per cent. of those fed for 6 weeks on a person who had had the disease 6 months previously.

Rickettsiae were obtained from lice injected with the centrifuged urine of infected persons. The differences between this disease and others caused by rickettsiae and the possible origin of the outbreak are discussed.

PCHENICHNOF (A. V.) & RAIKHER (B. I.). **Recherches expérimentales sur la transmission du virus du typhus exanthématique des poux malades aux poux sains par voie buccale. Contribution à la solution du problème épidémiologique de la conservation du virus pendant les périodes interépidémiques.**—*Arch. Inst. Pasteur Tunis* **25** no. 3–4 pp. 402–418, 1 pl., 3 graphs, 1 ref. Tunis, November 1936.

In an attempt to determine whether the virus of epidemic typhus may be maintained during inter-epidemic periods by transmission from infected to healthy lice [*Pediculus humanus*, L.], the authors undertook the experiments that are here described in some detail. When a suspension of lice that had fed on a person infected with epidemic typhus (and were proved to have contracted the infection) was spread on the skin of an immune person, and uninfected lice were allowed to feed on the site, they were proved by various means to have contracted the infection by ingestion. In a similar experiment in which the skin of the man was painted with a suspension of lice infected with an intestinal disease of unknown origin, mass infection of healthy lice resulted, although the disease was not transmissible by contact. Further experiments showed that it was possible to transmit this disease to successive lots of uninfected lice by spreading on the skin suspensions of the lice from the batch previously infected. The infection of successive batches of lice was also found to be possible when lice infected with typhus were used, and the virus was conserved for 36 days in 3 successive batches of lice by oral infection, without the intervention of an infected person. The virus did not undergo any appreciable modification in the course of the passages through lice. Thus healthy lice feeding on the skin of a man on which infected lice have been crushed may become infected.

DAUBNEY (R.). **Report of the Chief Veterinary Research Officer.**—*Rep. Dep. Agric. Kenya 1935* **2** pp. 130–162. Nairobi, 1936.

In an investigation carried out by W. Fotheringham and E. A. Lewis on the ability of ticks other than *Rhipicephalus appendiculatus*, Neum., to transmit African coast fever (*Theileria parva*) of cattle in Kenya, normal transmission was obtained by means of *R. simus*, Koch, and *R. evertsi*, Neum., and *Hyalomma impressum*, Koch, transmitted the disease experimentally in the nymphal and adult stages. Under carefully controlled conditions, it was not transmitted by *Amblyomma variegatum*, F., *Rhipicephalus pulchellus*, Gerst., or *R. sanguineus*, Latr.

An account is given of work on *Glossina pallidipes*, Aust., in the Lambwe Valley and its vicinity, and of its local distribution there. Elephants appear to be favourable hosts for the fly, since the numbers of fly caught are small when elephants are in, or have recently left, the neighbourhood. They do not, however, seem to be of importance in spreading the fly.

Bedford (H. W.). **Entomological Section Agricultural Research Service. Veterinary Entomology.**—*Rep. agric. Res. Serv. Sudan 1935* pp. 94–95. Wad Medani [1936].

Recent surveys have indicated that *Glossina morsitans*, Westw., which is normally confined to a limited belt in the Koalab Hills, does not spread beyond them during the rainy season, and that trypanosomiasis of cattle in the Anglo-Egyptian Sudan is probably transmitted by other species of biting flies, which increase in numbers at this time of the year.

Mackerras (I. M.). **The Sheep Blowfly Problem in Australia. Results of some recent Investigations.**—*Pamphl. Coun. sci. industr. Res. Aust.* no. 66, 39 pp., 3 pp. refs. Melbourne, 1936.

A comprehensive summary is given of the research work that has been carried out in recent years on sheep blowflies and their control in Australia by the Council for Scientific and Industrial Research in collaboration with the New South Wales Department of Agriculture. Much of the information is taken from papers already noticed and some from articles that have not yet been published.

The three main sections of the paper deal, respectively, with the bionomics of the blowflies, particularly *Lucilia cuprina*, Wied., with the factors that influence the susceptibility of sheep to infestation by the maggots, including the predisposing conditions in the sheep and the immediate causes, such as weather, moisture, bacterial activity, etc., and with the prevention of strike including methods of reducing the abundance of flies and methods of protecting the sheep.

Downing (W.). **The Life-history of** *Psoroptes communis* **var.** *ovis* **with particular Reference to latent or suppressed Scab.**—*J. comp. Path.* **49** pts. 2–3 pp. 163–180, 183–209, 12 figs., 10 refs. Croydon, 1936.

Observations in Britain over a number of years have shown that sheep that have been heavily infested by *Psoroptes ovis*, Hering, during the winter and have not been treated often appear to have recovered during the summer, but become heavily infested again in the autumn [*cf. R.A.E.*, B **25** 21]. Experiments were begun in December 1932 in the hope of elucidating this problem of latency or suppressed scab. A description is given of the method of making microscopical examinations of mites confined in small cages with removable lids on the backs of living sheep strapped to a specially constructed table. The morphology and bionomics of all stages are described. The average length of the female life-cycle from egg to egg was 10·7 days, the egg, larval, nymphal, and pubescent female stages lasting 2·7, 2·2, 2·3 and 2·2 days, respectively, and the pre-oviposition period in ovigerous females 1·3 days. From nymphs of the same age, the males emerged 2·5–3 days after the pubescent females or about 7–8 days after the hatching of the eggs. Observations on the clinical aspect of the disease in sheep are divided into three parts: active scab in winter, active scab in summer, and latent or suppressed scab. It was established that, in all cases in which active scab becomes latent in the summer and reverts to the active phase in the following winter, mites are present on the sheep throughout the period of

latency, and, although ovigerous females predominate, any stage may be found. There is a definite cessation of activity in summer, and the infestation does not extend, because the mites remain confined to certain naturally protected areas and small inactive lesions where they find shelter. When the latent period is over, the mites tend to leave the protected areas and scatter over the body surface ; at this time, the latent lesions again become active, owing to the centrifugal migration of the mites, which feed and so create a zone of active scab. There is no intrinsic difference in the mites causing active and rapidly progressive scab in winter or active and very slowly progressive scab in summer ; and there is no evidence of suspension of the life-cycle (with a resting phase in one particular stage) during the period of latency, but the rate of oviposition appears to be much reduced, as is evidenced by the high ratio of adults to immature stages found at this time.

With regard to the factors controlling latency, it would appear that climatic conditions play an important part, since the period of latency corresponds to the period of warm weather. Humidity at the surface of the skin may also influence the rate of oviposition, for the affected areas were always more or less denuded when the period of latency began and the degree of humidity in the immediate environment of the mites must consequently have been much lower, whereas, when infestation again became active, the wool had grown over the bare patches. In all cases but one, latent scab developed in sheep that had been infested during the winter or early spring (before April) and on which the scab had developed over almost the entire body, leaving the skin crusted, wrinkled and indurated. In the autumn, when activity recommenced, the wool had grown and the skin had to a large extent regained its normal condition. On sheep that had had more than one attack of scab, the skin did not regain its normal condition so readily during the second latent phase, and the scab did not progress so rapidly when activity recurred. These factors indicate that there is some reaction in the skin that affects the mites and tends to reduce the rate of oviposition. Thus the apparent freedom of sheep from the disease in summer is due to a reduction in the rate of multiplication of the mites, together with an increase in mortality due to unfavourable conditions. Active scab in summer occurs in clean sheep infected late in spring, when, although the weather is warm, skin reaction is favourable. Slowly progressive or chronic winter scab occurs in sheep that have not completely recovered from a second latent phase ; in these cases, the climatic conditions are favourable but the skin conditions are not. The clinical symptom of pruritus is dependent on the number of mites feeding on the skin, and this again depends on the rate of oviposition. A graph of the number of outbreaks of scab per month for the years 1929–34 shows that there is a marked decrease during the summer, followed by a great increase during the winter, thus indicating that latency is not merely a phenomenon observed in experimental animals.

The fact that the shortest interval from hatching to the appearance of the egg was 8 days might suggest that the usual minimum interval of 10 days between dippings is too long. The males take longer to reach maturity, however, so that, if all of them were killed before the first dipping, the newly emerged females would have to wait for 2½–3 days before they could pair and oviposit. Moreover, if sufficient dip remains in the fleece to kill all larvae that hatch during the 2 days following treatment, the 10-day interval will again be sufficient. Attempts to

infest dipped sheep artificially were not successful until the 21st day with a carbolic dip and the 53rd day with an arsenic-sulphur dip, but these sheep were not exposed to rain. If sheep are dipped during the latent period, when the mites are sheltering in the infra-orbital fossae, the inguinal folds, etc., ordinary dipping without hand dressing is less likely to be effective. As the mites tend to migrate from these hiding places in the autumn, it is suggested that dipping at this time, when they are more accessible, would probably be more effective than the present summer dipping.

SUGIMOTO (M.). **On the Formosan Chicken Mite,** *Neoschöngastia gallinarum* **(Hatori 1920). I.** [*In Japanese.*]—*J. Soc. trop. Agric.* **8** no. 3 pp. 241–252, 1 pl. Taihoku, Formosa, October 1936.

A description is given of *Trombicula* (*Neoschöngastia*) *gallinarum*, Hatori, which is widely distributed in Formosa, occurring on fowls and various wild birds, including sparrows. Fowls are usually infested under the wings and young ones are sometimes killed. A list is given of the other mites that are known to attack fowls in various parts of the world.

SUGIMOTO (M.). **On the Ixodidae of Formosa.** [*In Japanese.*]—*Bull. Res. Inst. Formosa* no. 124 11 pp. Taihoku, Formosa, November 1936.

A list is given of the Ixodids of Formosa, with descriptions of *Haemaphysalis cornigera* var. *taiwana*, n., from buffaloes, and *Ixodes taiwanensis*, sp. n., from dogs.

SUGIMOTO (M.). **Ticks and the Part they play in the Transmission of Diseases.** [*In Japanese.*]—*J. Taihoku Soc. Agric. For.* **1** no. 3 pp. 245–250. Taihoku, Formosa, November 1936.

A general account is given of the bionomics of ticks and of some of the diseases of domestic animals of which they are the vectors. In Formosa, piroplasmosis of cattle is transmitted by *Boophilus* (*Margaropus*) *annulatus microplus*, Can. (*australis*, Fuller).

BISHOPP (F. C.) & HIXSON (H.). **Biology and economic Importance of the Gulf Coast Tick.**—*J. econ. Ent.* **29** no. 6 pp. 1068–1076, 2 figs., 3 refs. Menasha, Wis., December 1936.

Amblyomma maculatum, Koch, has been of local economic importance in the United States for many years, but, since the invasion of the Gulf States east of Louisiana by *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), its importance has greatly increased, because the injury it causes to cattle and other domestic animals is one of the chief factors predisposing them to infestation by the fly [*cf. R.A.E.*, B **24** 5, 6]. The necessity for devising measures for its control has led to investigations on its bionomics, and the preliminary findings are reported in this paper. It occurs in the United States in areas adjacent to the Gulf of Mexico and on the Atlantic coast in Florida, Georgia and the southern part of South Carolina. It has also been recorded from the east coast of Mexico, the West Indies, and various countries in South America. It is seldom found more than 100 miles inland. Its distribution indicates that rather high rainfall, humidity and temperature are necessary for its existence, and experimental work tends

to confirm this assumption, though the larvae and nymphs are fairly resistant to cold. It usually attaches itself to the inner surface of the external ear of various animals, and, although the scabs and cracks resulting from the irritation caused are distinctly detrimental to livestock, their chief importance lies in their attraction for gravid females of *C. hominivorax*. Since the mass of ticks causes the ear to swell and become stiff, the flies can oviposit undisturbed. The blood and serum discharged when the fly larvae burrow into the tissues of the ear attract further flies, the jaw, throat and eyes may become infested, and, if the lesions are left untreated, the skull may be laid bare and the animal may die. The adult ticks attack mainly the larger domestic and wild animals, whereas the larvae and nymphs prefer small wild animals and birds. Man is only occasionally infested. Lists are given of the recorded hosts, which include cattle, sheep, goats, horses and dogs.

Pairing takes place on the host, and females do not apparently engorge in the absence of males. Individuals have been observed to remain on a host for 70 days without feeding. Engorgement requires 5–18 days, but males may remain attached for weeks after the engorged females have dropped to the ground. Oviposition in some protected spot may begin on the second day after dropping, but the pre-oviposition period may be greatly prolonged during cool weather, when the average daily maximum temperature is below 70°F. Oviposition continues for 13–75 days. The average number of eggs deposited is more than 8,000 ; one female laid 18,497, the largest number recorded for any tick in the United States. The incubation period is about 3 weeks during warm weather, when the mean temperature is 80–81°F., but may last for nearly 5 months in the case of eggs laid late in the autumn. The longevity of unfed adults under laboratory conditions has been reported to range from 144 to between 388 and 411 days. The larvae, which, soon after hatching, crawl about in the grass and weeds within a radius of 2–3 yards, attach themselves mainly to the head and neck of birds and to the head and ears of mammals. The longevity of unfed larvae ranged from 3 months in summer to 6 months in winter and was greatly reduced when humidity was low. The different periods required for engorgement on various birds and rodents in the laboratory are given ; they ranged from $2\frac{1}{2}$ to 10 days. Most of the engorged larvae leave the host during the night or early morning and crawl between grass stems slightly above the ground, where they moult in 1–3 weeks. A maximum moulting period of 121 days has been reported. The nymphs are usually ready to attach themselves about a week after moulting, and they engorge in $4\frac{1}{2}$–7 days. After dropping from their hosts, they seek shelter in places similar to those chosen by the larvae. Moulting usually takes 3–4 weeks. The winter is usually passed in the larval or nymphal stage. The numbers of adults that occur on animals in spring are small, but they usually increase rapidly on livestock in July and reach a peak in late summer or early autumn.

Control is difficult, because the tick occurs on wild animals and birds as well as on domestic ones, it does not remain long on any one host, and it is very long-lived. Although it cannot be eradicated by the arsenical dipping practised against the cattle tick (*Boophilus annulatus*, Say), its numbers will doubtless be reduced, especially if the insides of the ears are thoroughly wetted. Dipping is not advised against *A. maculatum* alone, since it is costly and some of the ticks in the ears

are not killed. Light applications of commercial pine-tar oil with a swab to the inside of each ear of all domestic animals at intervals of two week gives very satisfactory control; the grade used as a repellent for *C. hominivorax* [**24** 5] is recommended. The treatment not only kills the ticks but also prevents reinfestation for 10–14 days. Little information on the efficacy of range burning is available. Although most of the larvae and nymphs would appear to be on the ground during the winter, some may escape in pastures with scattered vegetation, as the entire area is not covered by the fire; moreover, the burned land becomes re-infested with ticks brought in on birds and other hosts. The open range grazing of stock, which is practised over much of the coastal plain, is favourable to the tick; animals should be kept where they can be treated regularly with pine-tar oil. Pigs running wild are hosts of this and other ticks and of *Cochliomyia*, so that their presence is detrimental to livestock on the same range.

Dove (W. E.) & Bishopp (F. C.). **The Screw Worm Situation in 1935.**—*J. econ. Ent.* **29** no. 6 pp. 1076–1085, 1 fig., 4 refs. Menasha, Wis., December 1936.

During 1935, *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) was probably more widely distributed in the United States than ever before. Outbreaks in the north-central States are attributed to its dispersal from the south-west, where it was unusually abundant. Its limited spread in the south-east suggests that the measures taken for its control there were successful and prevented its spread. Details are given of the infestations occurring before 1st July. In Florida and Texas, the fly was active throughout the winter [*cf. R.A.E.*, B **24** 6], and control work should therefore be carried out in these States throughout the year, but particularly during the winter.

In the six south-eastern States and in 19 counties of south-eastern Texas, where an educational programme for its control was carried out, 242,502 cases of infestation were reported between 1st July and 15th December. Of these, approximately seven-eighths occurred in cattle and pigs. The predisposing causes in the great majority of the cases were injuries of various kinds that could be prevented by better methods of handling animals; nearly 50,000 cases were associated with bites of *Amblyomma maculatum*, Koch. The effect of the control measures carried out as a result of the education programme are discussed; they not only reduced the number of cases and the percentage of mortality, but also prevented the spread of the fly. They included control of *Cochliomyia* and ticks in sheep by the application of pine-tar oil; the tipping of horns, which reduced the cases due to goring and to dehorning operations; better methods of caring for livestock; and efforts to obtain control of or to eliminate uncontrolled pigs in unfenced woods, since these are now recognised as the principal reservoir of fly in these States.

The total number of livestock recorded for the south-eastern area in 1935 was 9,722,236 animals, so that 2·49 per cent. were infested. The deaths numbered 5,215. These figures compare favourably with those reported during 1934 [*cf.* **23** 220; **24** 5, 6] and indicate the effectiveness of the education programme. Further control can only be obtained by more intensive application of the measures already suggested, particularly the control of infestations in pigs.

Data from 96 counties in Texas outside the control area show 1,210,117 cases of infestation (principally in cattle, pigs, horses, mules, goats and sheep) with 178,196 deaths ; using figures from the animal census of 1930, this amounts to an infestation rate of 17·96 per cent. It would appear that the total losses in Texas in 1935 might be estimated at about £2,000,000. The prevalence of the fly in Texas and other parts of the south-west, together with the increased transport of stock during the summer to pastures in the north, led to its distribution to the north-central States, where many of the farmers were unfamiliar with it and nothing was done to control it until after the larvae had dropped to the ground and infested new areas. It then spread further afield by flight and by local movement of stock. These findings show the need for intensive control work in southern Texas and for some method of checking the movement of infested animals into uninfested territory.

MAIL (G. A.). **Thiodiphenolamine—a new Ingredient of Mosquito Larvicides.**—*J. econ. Ent.* **29** no. 6 pp. 1144–1146. Menasha, Wis., December 1936.

Thiodiphenylamine (phenothiazine) is a milky green substance with the formula $S(C_6H_4)_2NH$ and a molecular weight of 199·14. It is very soluble in benzene and acetone, soluble in ether, and slightly soluble in alcohol. Tests of its value as a mosquito larvicide were begun in Montana in 1935. In preliminary laboratory experiments, it proved less effective when used alone as a dust than when mixed with 95 per cent. road dust, or with kerosene. In other experiments in the laboratory and in natural breeding places, it was tested in various combinations with various oils ; in every case it increased the toxicity of the oil. More exact tests were then made in which it was tested, in combination or alone, with about 50 other larvicides ; diesel-engine oil, furnace fuel oil and crank-case drainings were finally selected for additional experiment. Thiodiphenylamine did not completely dissolve when added to these materials, but the toxic element was apparently soluble, for the supernatant liquid from a mixture that had stood for 24 hours was as toxic as a freshly made and constantly agitated mixture, or a mixture made by adding the thiodiphenylamine dissolved in acetone. This finding may be of practical value, since a suspension would probably vary in strength unless it were adequately agitated, and the suspended matter might clog the nozzles of the spraying apparatus. Although crank-case drainings are cheap and readily available in Montana, they are not considered suitable as a larvicide, because they do not spread well, are not very toxic and vary in composition. The addition of 5 per cent. cresoap improved their spreading power and the further addition of 1 per cent. thiodiphenylamine greatly increased their toxicity, but on account of their variable composition they were discarded in favour of diesel oil. The addition of thiodiphenylamine, even in small amounts, markedly increased the toxicity of this oil ; thus, when used at the rate of 0·3 cc. to 800 sq. cm. water surface, the supernatant liquid from 100 cc. oil mixed with 0·5 gm. thiodiphenylamine gave 100 per cent. mortality in 5 hours, whereas the diesel oil alone only gave 55 per cent. It is concluded that the addition of thiodiphenylamine will increase the toxicity of a larvicidal oil and thus enable the quantity used to be reduced.

LINDQUIST (A.). **Parasites of the Horn Fly and other Flies breeding in Dung.**—*J. econ. Ent.* **29** no. 6 pp. 1154–1158, 2 refs. Menasha, Wis., December 1936.

In the course of investigations at Uvalde, Texas, on parasites of Diptera breeding in dung, two Pteromalids, *Spalangia muscidarum* var. *stomoxysiae*, Gir., and *S. drosophilae*, Ashm., were frequently observed in cow-dung, and it was thought that they might prove to be valuable parasites of the horn fly, *Lyperosia* (*Haematobia*) *irritans*, L. Information on them and their relations to flies in cattle dung has been collected since 1932. It was found that they are attracted to dry or partly dry cow-dung and, in their search for host pupae, follow the tunnels made by Dipterous larvae and small dung beetles. *S. m. stomoxysiae* readily attacks pupae of *Cryptolucilia*, *Sarcophaga*, *L. irritans* and *Musca domestica*, L. *S. drosophilae* usually parasitises small dung-infesting Diptera, but will attack *L. irritans*; it also proved to be hyperparasitic on two blowfly parasites, *Alysia ridibunda*, Say, and *Psilodora rufocincta*, Kieffer, which were being reared in the laboratory. During May–August 1933, when the average daily temperature was 83·1°F., the average developmental period for *S. m. stomoxysiae* on a variety of hosts, chiefly *L. irritans*, was 22·8 days, with a maximum of 35 and a minimum of 17. The shortest periods of development (less than 20 days) occurred during the hottest part of the summer when the mean daily temperature was 86·7°F. In cattle droppings in the field, it was shorter than in the laboratory. The duration of the developmental period of *S. drosophilae* was approximately the same. In both species, pairing takes place shortly after emergence, the males usually emerge slightly before the females, and only one adult issues from each puparium. The progeny of one female of *S. m. stomoxysiae*, provided with pupae of *Sarcophaga* and *Cryptolucilia* over a period of 15 days, consisted in one instance of 70 females and 12 males and in another of 32 females and 17 males. Of 732 adults of this species that emerged, 66 per cent. were females. Unfertilised females give rise to males only.

To determine the percentage of parasitism by *Spalangia* and to discover other parasites, pads of dung 3–4 days old were taken from the field and placed on separate pans of sand in the laboratory yard. When the dung was 8–10 days old, fly pupae were removed from it and from the sand and kept in vials. It was found that 18·7 per cent. were parasitised by *Spalangia* (of which more than 95 per cent. were *S. m. stomoxysiae*) and 24·2 per cent. by Staphylinids. *Spalangia* was obtained from 54 per cent. of the droppings in the laboratory and from 48 per cent. of those under cages in the field. A few of the Staphylinids emerging from the pupae of *Cryptolucilia* and *Sarcophaga* were identified as *Aleochara* (*Baryodma*) *bimaculata*, Grav., and it is probable that the others were of the same species. The newly hatched larva gnaws a minute hole in the host puparium, through which it enters, and devours the host. It goes through a hypermetamorphic development requiring approximately 20 days. No beetles emerged from puparia of *Lyperosia* and in only one instance was a beetle larva found in one of them. As pupae of this fly were scarce in dung from the field, small patches of fresh uncontaminated dung on sand in pans were exposed to females in cages at intervals between 4th July and 14th December 1933. From 1–3 days after oviposition, the dung was exposed to natural parasitism in the yard, and treated similarly to the

pads of dung previously used. About 15 per cent. of the pupae were parasitised by *Spalangia*, and again more than 95 per cent. of the parasites were *S. m. stomoxysiae*. *Spalangia* was most active in July, and the amount of parasitisation decreased gradually throughout the autumn. In a series of pads of dung infested with *L. irritans* and exposed to *Spalangia* in cages in June 1933, the average percentage of pupae destroyed was 55·19.

SEARLS (E. M.) & SNYDER (F. M.). **Relation of Viscosity to Drop Size and the Application of Oils by Atomization.**—*J. econ. Ent.* **29** no. 6 pp. 1167–1170, 1 ref. Menasha, Wis., December 1936.

Studies on sprays to protect cattle from flies indicated that it was not possible to apply efficiently oils of all viscosities with the same atomiser. With the atomiser used, oils of low viscosity were applied quickly and easily and covered the coats of the animals effectively, whereas those of higher viscosity took a longer time to apply and the spray produced was less effective, since it drifted about and beyond the animals without wetting them. Oils used as carriers for insecticides should be less volatile than kerosene if the insecticide is to be maintained in an active condition on the coat of the animal during the period of the day when the flies are active. The investigations described were undertaken to determine the relation between viscosity and drop size when a common fixed-nozzle atomiser of the suction type was used. Kerosene (viscosity 33·2 Saybolt) and a highly viscous oil (111·5 Saybolt) were tested alone or in mixtures in which the percentage of the latter was gradually increased from 10 to 90, together with 9 commercial fly-sprays with oils of viscosities ranging from 34·2 to 79·9 Saybolt. Microscope slides covered uniformly with lamp black were exposed for 1 second at a distance of 48 inches from the nozzle. A table shows the mean size of drops in square millimetres (S), the mean number of drops per 0·1 sq. mm. (N) and the time in seconds required to spray 25 cc. (T). Since the value $S \times N$ could be made equal for oils of all viscosities if sufficient oil and time were available for application, the value $S \times N \div T$ was used to present the effectiveness of the atomiser. In measuring the droplets, it was found that very few of those of less than 34 microns in diameter and none of those of less than 17 microns were recorded on the slides. As the viscosity of the oil increased, the droplets became smaller, and fewer of them struck the slide, so that a much larger part of the spray drifted round and past it. The less viscous oils were deposited in droplets of larger average size, showed fewer droplets of less than 34 microns in diameter, and were more effective in wetting the slides.

The data obtained, together with observations made during the study, indicate that, to be effective, an atomiser must produce a spray having a value for $S \times N \div T$ of at least 0·03.

ROUBAUD (E.) & COLAS-BELCOUR (J.). **Notes biologiques sur l'***Ornithodorus delanoëi*.—*Bull. Soc. Path. exot.* **29** no. 9 pp. 963–966, 2 refs. Paris, 1936.

Notes are given on the biology of *Ornithodorus delanoëi*, Roub. & Colas-Belcour, which has been reared in the laboratory since 1929 [*cf. R.A.E.*, B **20** 63]. Although the ticks have been maintained at temperatures of 25–28°C. [77–82·4°F.], their development has been

slow, but it is possible that this may be partly explained by the fact that they have been fed on guineapigs and not on porcupines, which appear to be their natural host. The life-cycle may last for from 5 to 6 years, and, after one blood meal, adults may remain alive without further nourishment for more than 5 years.

GASCHEN (H.) & MARNEFFE (H.). **Infection naturelle de** *A. hyrcanus* **var.** *sinensis* **dans le delta du Fleuve Rouge.**—*Bull. Soc. Path. exot.* **29** no. 9 pp. 970–975, 24 refs. Paris, 1936.

Until recently, no Anopheline infected with malaria parasites had been found in the Red River Delta, Tonkin, but as *Anopheles aconitus*, Dön., a known vector in Indo-China, is present, it was suspected of transmitting the slight endemic malaria that exists in all the provinces of the Delta, where sudden epidemics periodically occur. In the course of one of these outbreaks, 398 females belonging to 6 species were dissected, and only *A. hyrcanus* var. *sinensis*, Wied., was found infected ; 8 out of 163 females contained parasites in the stomach or salivary glands [*cf. R.A.E.*, B **22** 259]. This finding is of importance, since the species is ubiquitous. The literature on the part played by it in the transmission of malaria in different parts of the world is briefly reviewed.

SICAULT (G.) & MESSERLIN (A.). **Note sur la destruction des larves par les naphtes et sur l'activation des mazouts.**—*Bull. Soc. Path. exot.* **29** no. 9 pp. 1023–1032. Paris, 1936.

Since oiling against mosquito larvae has been carried out on a large scale in Morocco, very variable results have been obtained with fuel oils extracted locally from Moroccan crude oils. A study was therefore made of the mechanism of larvicidal action, with a view to finding some means of accelerating the action of natural oils, which is sometimes too slow to kill the larvae before the film is broken.

A series of experiments in which larvae were kept from contact with the air showed that death by asphyxiation is slow, and that larvae are killed more rapidly when the water is covered with a layer of vaseline oil, olive oil, or liquid paraffin than when air is mechanically excluded, though the action of these compounds is much slower than that of gas oil. A second series of experiments was designed to ascertain what produces the rapid action of gas oils and the differences in the effectiveness of fractions of crude oil. The following products obtained from successive distillations were tested on larvae by being sprayed on the surface of the water at the rate of 20 cc. per square metre : petroleum ether (distilling below 50°C.), petrol (between 80 and 130°) kerosene (130–280°), gas oil (280–400°), engine oil (280–400°), vaseline oil (335–400°) and liquid paraffin (375–435°). The densities, relative viscosities and interfacial tensions of these distillates and of olive oil are shown in a table. The first four acted most rapidly, but petroleum ether evaporated so quickly that some of the larvae survived. The best results were obtained with gas oil, only one out of 20 larvae remaining alive at the end of an hour. It appeared that the physical properties of the distillates had little influence on their larvicidal value, which depends less on asphyxiation due to the blocking of the respiratory organs than on toxicity. Thus the larvicidal power of vaseline oil was considerably enhanced by the addition of small quantities of naphthalene or pyrethrin.

Experiments with a number of substances, including naphthalene, camphor and paradichlorobenzene, showed that in a confined space larvae may be killed by vapour. Good results were obtained when these and other substances were added to gas oil at the rate of 0·1 gm. to 20 cc. and sprayed at the rate of 20 cc. oil per square metre, but most of the substances were too expensive for use in the field. Further tests were made with paradichlorobenzene, naphthalene, and oleoresin of pyrethrum, which were both effective and cheap, to determine what amount had to be added to commercial gas oil to kill all larvae in less than two hours when the spraying rate was reduced to 7 cc. per square metre. The amounts were 0·5, 0·25 and 0·1 per cent., respectively. Naphthalene was finally selected, as the additional cost was much less than for the other two products.

FINDLAY (G. M.) & DAVEY (T. H.). **Yellow Fever in the Gambia. I. Historical.**—*Trans. R. Soc. trop. Med. Hyg.* **29** no. 6 pp. 667–678, 1 graph, 27 refs. London, 1936. **II. The 1934 Outbreak.**—*Op. cit.* **30** no. 2 pp. 151–164, 1 pl., 1 map, 8 refs.

In the first part of this paper, the history of outbreaks of yellow fever, or diseases closely resembling it, in the Gambia is outlined. Acute fatal epidemics among Europeans have occurred for 480 years. Absolute proof that the earlier outbreaks were due to yellow fever is lacking, but, in view of the uncertainty whether the disease is of African or American origin, it is pointed out that there was no change in the general character of the epidemics after the discovery of America, the institution of the slave trade, or the general introduction of cinchona bark as a routine treatment for tropical fevers. Since the foundation of Bathurst in 1816, it is noticeable that there is no history of any outbreak of yellow fever among Africans in any other part of the Protectorate and only three deaths among Europeans. The authors list the arguments for and against the African origin of yellow fever, and suggest that there may be both an African and an American strain of the disease.

In the second part, the outbreak of yellow fever that occurred in Bathurst in 1934 is described. Protection tests made with blood samples from 5 villages gave positive results ranging from 20 to 33 per cent. The list of mosquitos recorded from the Gambia includes *Culex fatigans*, Wied., *C. thalassius*, Theo., *Aëdes aegypti*, L., *A. luteocephalus*, Newst., *A. vittatus*, Big., *A. simpsoni*, Theo., *Eretmapodites chrysogaster*, Graham, and *Mansonia africana*, Theo., which have been shown experimentally to be capable of transmitting the virus by bite, and *Aëdes irritans*, Theo., *A. nigricephalus*, Theo., and *Mansonia uniformis*, Theo., which have produced the disease when injected. *A. aegypti*, which is undoubtedly the commonest vector of yellow fever present on the Island of St. Mary (on which Bathurst is situated), is relatively rare elsewhere, and it seems unlikely, therefore, that it plays an important part in the transmission of yellow fever in rural areas. The authors discuss possible explanations of the occurrence at intervals of epidemics of yellow fever in Bathurst, and of the apparent occurrence of the disease in rural areas (as shown by the immune bodies in sera of persons living there) in the complete absence of epidemics. The evidence suggests that the disease is not endemic in the town, but that the virus is periodically introduced either by man, in the blood of an infected animal, or even by immigration of infected mosquitos, the actual

occurrence of an epidemic depending on the proportion of non-immune persons in the population and on the density of the vectors. The possibility that rural yellow fever in Africa is similar to jungle yellow fever in South America [*cf.* *R.A.E.*, B **24** 34] is suggested.

La Face (L.). **Fauna anofelinica delle Colonie italiane.**—*Riv. Parassit.* **1** no. 1 Suppl. 120 pp., 29 pls., 73 refs. Rome, January 1937.

This survey, which is largely based on the literature, deals with the Anophelines of Libya, Eritrea, Italian Somaliland and Abyssinia. Lists are given of the species that occur in each territory and of those thought likely to occur because of their presence in neighbouring areas. Notes on all these species include descriptions of the adults and occasionally of immature stages, with some observations on bionomics.

Missiroli (A.). **Influenza di alcuni fattori climatici sull'** *Anopheles maculipennis.* [The Influence of some climatic Factors on *A. maculipennis.*]—*Riv. Malariol.* (1) **15** no. 6 pp. 385–398, 1 fig., 4 graphs, 4 refs. Rome, 1936. (With Summaries in English and German.)

Experiments with a tunnel similar to that used by Shannon [*R.A.E.*, B **23** 96] have been made in Italy to ascertain the effect of microclimate on *Anopheles maculipennis*, Mg. The entrance to the tunnel faced east and was a small chamber closed by a wire screen door from which steps led up to the surface of the ground. The tunnel itself was about 7½ ft. high by 5 ft. wide, with a straight length of 53 ft. ending in an arm at a right angle to it 7 ft. long. Partial partitions of wood divided the long portion into three sections of about 16½ ft., the arm forming a fourth section, differentiated from the third in that the light reaching it was less than 0·05 lux and therefore not measurable with the photo-electric meters used. Recording thermometers and hygrometers were placed in the sections.

In July, the morning temperature in the first section soon rose to 24°C. [75·2°F.] and then fell slowly to 17°C. [62·6°F.] during the next 24 hours ; there was a relative humidity of 70–86 per cent. and a light intensity of 150 lux. In the second and third sections, the temperatures were 17–19°C. [62·6–66·2°F.] and 16–18°C. [60·8–64·4°F.] respectively, the humidities 76–84 and 82–88 per cent., and the light intensities 10·5 and 0·9 lux. No temperatures and humidity are given for the fourth section.

From experiments in which examples of *A. maculipennis* race *labranchiae*, Flni., and race *atroparvus*, van Thiel, were kept for a week or more in gauze cages in each of the first three sections, it appeared that mortality decreased progressively with both races from the first section to the third. In an experiment in which 70 engorged females of *labranchiae* were liberated in the entrance chamber, however, most of them were later found in the second section and only a few in the third, the one in which conditions were best for their survival. The majority preferred the second section during the first three days, but on the fourth day, when they were empty or with eggs in an advanced stage of development, they began to pass to the first section and the entrance chamber. The influence of the microclimate on Anophelines thus appears to vary with physiological conditions of nutrition and reproduction.

Gösswald has shown that *Sphinx pinastri*, L., has a constant population, being little affected by temperature and humidity [A **24** 339]. In the case of *A. maculipennis*, on the other hand, mass increases have been observed in June and September, so that it appears to be sensitive to climatic conditions. Mosna, who collaborated with the author, was able to ascertain that, like *A. plumbeus*, Steph. [B **24** 112], each race of *A. maculipennis* has a given optimum temperature for larval development, which for *labranchiae* alternates between 30 and 35°C. [86–95°F.] during the day and between 20 and 25°C. [68–77°F.] during the night. The thermal zone of maximum speed of development coincides with that of minimum mortality during the immature stages. Kozhanchikov [A **23** 753] has shown that the vital optimum for *Loxostege sticticalis*, L., is represented by the climatic conditions that produce the greatest reproductive activity, the least mortality during the developmental cycle, and the most rapid completion of the individual cycle. Further experiments with engorged females of *labranchiae* in cages showed that, though mortality was highest in the first section of the tunnel, digestion of blood and maturation of eggs were quickest there. In the second section, however, digestion was only slightly less rapid, whereas mortality was distinctly less. In the third and fourth sections, digestion and egg maturation required twice as long as in the second, though with less mortality during the first week.

It is concluded that, if the rate of mortality and egg maturation are considered together, the second section provided the optimum conditions, and such a microclimate must be sought by the adults when the weather results in a water temperature most favourable for the larvae. The different biotopes and temperatures required by the larvae and adults can occur in a given local climate, and the adults, through the instinct revealed in these experiments, can seek the conditions they require. The effect of climate thus explains instances of the sudden occurrence of *A. maculipennis* in large numbers.

ROSA (A.). **Sulla durata di vita delle varietà di** *Anopheles maculipennis*. [On the Duration of Life of the Varieties of *A. maculipennis*.]—*Riv. Malariol.* **15** no. 6 pp. 399–403. Rome, 1936. (With a Summary in English.)

The author records observations in Italy on the longevity of females of *Anopheles maculipennis* vars. *atroparvus*, van Thiel, and *messeae*, Flni., and *A. sacharovi*, Favr (*maculipennis* var. *elutus*, Edw.). The mosquitos were kept at 20–25°C. [68–77°F.] and fed on rabbits. At a relative humidity of 80–90 per cent., the percentages surviving for 20 days were 17·5 of *atroparvus*, 6·3 of *messeae* and 3·2 of *sacharovi*. At 45–55 per cent. humidity, the corresponding percentages were 0·7, 2 and 0.

PAPADAKIS (A. M.). **Head Markings of the Larvae of** *Anopheles maculipennis* **and** *A. sacharovi* **and their Systematic Importance.** [*In Greek.*]—*Iatr. Athen.* [Med. Athens] no. 88 reprint 8 pp., 4 refs. Athens, 1936; abridged in *Prakt. Akad. Athen.* **10** pp. 457–462. Athens, 1935. (With Summaries in English.)

Examination during 1932–33 of 1,018 larvae of *Anopheles maculipennis*, Mg., and *A. sacharovi*, Favr, taken in various types of breeding

places from widely separated localities in Greece indicated that the head pattern of the larvae is of no value in differentiating these two species. Observations on 662 larvae reared from known eggs in the laboratory support this conclusion. It would appear that the head pattern depends on the degree of sunshine or shade in the breeding place and probably also on the nature of the food. When shade and vegetation were dense, the larvae showed greater pigmentation of the head pattern (banded forms). Poor food and absence of shade and vegetation were correlated with faintly marked head patterns (spotted forms predominating) in larvae of both species.

[Monchadskiĭ (A. S.).] **Мончадский (А. С.). Les larves des moustiques (Fam. Culicidae) de l'URSS et des pays limitrophes.** [*In Russian.*]—*Tabl. anal. Faune URSS* no. 24, 383 pp., 162 figs., 5 pp. refs. Leningrad, 1936. Price 12 *rub.*; binding 2 *rub.*

This monograph on the larvae of the mosquitos of the Russian Union and neighbouring countries includes a general section (pp. 9–84) dealing with morphology, pigmentation, movement and growth, together with some discussion of identification and evolutionary tendencies, and a special section (pp. 85–375) containing descriptions of the larvae of 115 species, with keys and notes on breeding places and geographical distribution.

Curry (D. P.). **Canal Zone Sanitation.**—*Rep. Hlth Dep. Panama Canal 1935* pp. 13–16. Balboa Heights, C.Z., 1936.

The effect of the stabilisation of the level of Gatun Lake (by controlled release of impounded water from the new Madden Lake) on the conditions that favour Anopheline breeding [*cf. R.A.E.*, B **23** 94] already seemed to be evident in 1935. The level did not fall so low as in many previous years, and there was far less *Chara*, *Naias*, and *Utricularia* at the surface than usual. A brief account is given of the results of an intensive study of mosquitos and malaria transmission at Fort Sherman to the west of the northern end of the Panama Canal [*cf.* **24** 145]. The Anophelines found breeding in jungle-shaded swamps and streams were *Anopheles tarsimaculatus* var. *oswaldoi*, Peryassú, *A. eiseni*, Coq., *A.* (*Stethomyia*) *kompi*, Edw., *A. apicimacula*, D. & K., *A. punctimacula*, D. & K., *Chagasia* (*Anopheles*) *bathanus*, Dyar, and (in bromeliads) *A. bellator* var. *cruzi*, D. & K. Several cases of myiasis in man were found to have been caused by *Cochliomyia hominivorax*, Coq., but none by *C. macellaria*, F.

Russell (P. F.). **Malaria in India. Impressions from a Tour.**—*Amer. J. trop. Med.* **16** no. 6 pp. 653–664. Baltimore, Md, November 1936.

The author has recently spent six months in India studying malaria and attempts made to control it, and in the present paper gives briefly a few of his impressions. He indicates the magnitude and complexity of the problem, outlines the malaria situations in Bombay, Bengal, and Assam, and discusses the question of control. He concludes that Anopheline control is feasible in cities, in government undertakings and on organised plantations, but that it is not at present economically practicable in rural areas.

FITZGERALD (R. D.). **Malaria.**—*Rep. med. Dep. F.M.S. 1935* pp. 6–8. Kuala Lumpur, 1936.

There was an increase in the number of recorded cases of malaria in all four of the Federated Malay States during 1935, and, although it is unlikely that a serious epidemic will occur, control work must not only be maintained but also intensified if the tendency of the incidence to rise is to be checked. *Anopheles barbirostris*, Wulp, which had not previously proved to be a vector except in isolated cases, appeared to be the principal one in three districts in Perak [*cf. R.A.E.*, B **25** 68]. In another district of the same State, a definite increase in the incidence of malaria in the latter part of the year was apparently due to more intense breeding of *A. maculatus*, Theo., associated with the presence of a larger number of carriers. From the few records available, it seems likely that *A. maculatus* appeared recently for the first time in the district. In Selangor, the greatest rise in the incidence of malaria occurred in the coastal districts, where the principal vector is *A. umbrosus*, Theo.

YAMADA (M.). **Four Kinds of Anopheline Mosquitoes in Chosen.**—*Keijo J. Med.* **7** no. 2 pp. 191–210, 10 pls., 24 refs. Keijo, 1936.

The only Anophelines recorded from Korea are *Anopheles hyrcanus* var. *sinensis*, Wied., which is ubiquitous, and *A. koreicus*, Yam. & Watan., *A. edwardsi*, Yam., and *A. sineroides*, Yam., which are rare, breed for preference in cool water, and are found chiefly in hilly districts. During 1931–35, the author examined more than 10,000 Anopheline adults and larvae taken in the vicinity of Keijo and Taiden, and also numerous larvae, pupae and adults reared from eggs laid by captured females. Notes are given on methods for examining and preserving the eggs, larvae and pupae. The eggs, fourth-instar larvae and pupae of the four species are described, and keys are given to all stages. Records of distribution are appended.

VICARS-HARRIS (N. H.). *Glossina swynnertoni*, **Austen, in Relation to various Vegetation Types.**—*Bull. ent. Res.* **27** pt. 4 pp. 533–557, 18 diagr., 7 refs. London, December 1936.

The following is largely taken from the author's summary: A preliminary investigation has been made in Tanganyika Territory of the relations of *Glossina swynnertoni*, Aust., to types of vegetation, based on data obtained from fly-rounds at Shinyanga and Maswa, which were taken over by the author in November 1934 and April 1935, respectively. The fly-rounds and the 15 common types of vegetation are described. The rounds were split up into sectors according to the types of vegetation traversed, sectors of mixed vegetation being ignored, and the total length in yards of sectors of the same type was calculated. The monthly mean catches of fly for each type, expressed as the number per 10,000 yards, are presented in graphs, which thus show the monthly fluctuations in apparent fly density. The relative popularity of each vegetation type for each month is shown by expressing the number for it as a percentage of the total number for all types.

From the graphs, it would seem that definite preferences for different types of vegetation are exhibited by the fly at different seasons. During

the latter part of the rains, it appears to concentrate in the hard pan type (in which the chief trees are *Lannea humilis* and *Commiphora schimperi*, the grass is short, and there are small scattered thickets), the density being highest at the close of the rainy season. As the dry season advances, it disperses to the types where there is more shade or grass. Near the height of the dry season, it is often more abundant on hill-sides covered with woods of *Combretum* and *Brachystegia* than in the hard pan below. Where the hard pan is in immediate contact with extensive thickets or a strip of riverine forest, dispersal does not take place, and it is presumably to this type of hard pan that C. H. N. Jackson refers [*R.A.E.*, B **24** 26]; the fly remains in the hard pan and possibly uses the thicket for breeding and resting. Areas with an abundance of thicket become of increasing importance to the fly towards the end of the dry season. Throughout the greater part of the year in the Maswa area, it appears to prefer the forests of *Acacia rovumae*, in which thickets are numerous and the grass poor, and the hard pan fan slopes (grey soil areas found locally on the land immediately at the foot of granite hillocks and sloping away from them for 1–2 hundred yards to the normal reddish eluvial country that constitutes the higher ground on which the hillocks occur).

Hunger does not appear to be a factor of prime importance in influencing the fluctuations of apparent fly density in different types. Of those studied, the author believes that only the open grassland areas (with black cotton soil and patches of hard pan) can be classified as pure feeding grounds, and the results for that type are probably governed by the hunger factor. For the other types, the meteorological conditions ruling in the various vegetation communities at the different seasons are probably responsible to a greater extent for the apparent preferences of the fly.

THOMSEN (M.) & HAMMER (O.). **The Breeding Media of some common Flies.**—*Bull. ent. Res.* **27** pt. 4 pp. 559–587, 4 figs., 34 refs. London, December 1936.

A detailed account is given of observations and experiments on the breeding places of flies, particularly *Musca domestica*, L., and *Stomoxys calcitrans*, L., on farms in Denmark. The conclusions reached are similar to those noticed from an abridged report of the work [*R.A.E.*, B **22** 230]. Notes are given on a number of other flies that emerged incidentally from the various types of manure used in the experiments, including *Muscina stabulans*, Fall., *Hydrotaea dentipes*, F., *H. armipes*, Fall., *Fannia canicularis*, L., and *F. scalaris*, F.

MELLANBY (K.). **Experimental Work with the Tsetse-fly,** *Glossina palpalis*, **in Uganda.**—*Bull. ent. Res.* **27** pt. 4 pp. 611–632, 1 pl., 2 diagr., 14 refs. London, December 1936.

A detailed account is given of laboratory experiments with *Glossina palpalis*, R.-D., carried out in Uganda in 1935–36 and dealing mainly with the effects of climatic conditions, particularly temperature and humidity, on its metabolism and life-cycle.

The following is taken from the author's summary: From an examination of the results obtained by subjecting *G. palpalis* to

different humidities, it is concluded that, although excessive desiccation is harmful, the fly is able to withstand far drier conditions than those to which it is likely to be exposed in the field. It seems unlikely that the seasonal fluctuations in numbers round Lake Victoria are due to the harmful effects of the dry season. There is also no evidence that very moist air is in itself harmful. Experiments to determine how long flies could survive without food under various conditions of temperature and humidity showed that the rate at which water is lost is fairly slow, so that, except in very dry air, flies die of starvation before desiccation proves fatal. At 24°C. [75·2°F.] and relative humidities between 19 and 88 per cent., unfed males survived for from 3·46 to 5·64 days and unfed females for from 2·45 to 4·50, respectively, and fed males for from 4·61 to 8·29 and fed females for from 4·14 to 6·42. Breeding in the laboratory is unsatisfactory, because of the difficulty of making the flies feed regularly. The readiness with which they feed and the amount of blood imbibed are not affected by humidity.

The rate of metabolism is the same in dry and moist air. In dry air, water is lost more rapidly than in moist, but a blood meal contains so large an excess of water that the deficiency is easily replaced. *G. palpalis* exhibits a regular hunger cycle. The hungry fly has an empty gut and a small fat-body ; two days or so after feeding the gut is nearly empty and the fat-body is large ; subsequently the fat-body decreases and the fly again becomes hungry. It is only when the air is very dry that death occurs from desiccation before the fat has all been metabolised (when normally the fly seeks food). *G. palpalis* can withstand one hour at 41°C. [105·8°F.] in moist air and can cool itself sufficiently by evaporation to withstand one hour at 42°C. [107·6°F.] in dry air. It can withstand 39°C. [102·2°F.] for three hours at all humidities. These temperatures are above those occurring within its normal range.

It is possible to see living sperm in the spermatheca of a fertilised female. In the presence of males, females in the laboratory may avoid fertilisation for many weeks. The process of pairing is described. The presence of a high proportion of males does not cause abortion, for pregnant females are not pestered. Flies are not active, nor do they seek food, even if hungry, at temperatures below 21°C. [69·8°F.]. Below 8°C. [46·4°F.], they are completely immobilised, though, even after three hours at that temperature, they can feed within two minutes of transference to 25°C. [77°F.].

Hungry flies are more active than others. Increased light intensity and a raised temperature promote activity. Flies seem to be attracted to light, the optimum intensity being about a third of the intensity of sunlight. Pupae develop best in moist air ; in fairly dry air, adults are unable to escape from the puparia. In all places where puparia were found in nature, the air in the soil space was saturated, though the soil appeared to be quite dry [*cf. R.A.E.*, B **24** 240]. The active larvae show no reaction to light.

WOODHILL (A. R.). **Observations and Experiments on** *Aëdes concolor*, **Tayl. (Dipt. Culic.)**.—*Bull. ent. Res.* **27** pt. 4 pp. 633–648, 42 refs. London, December 1936.

A detailed account is given of a study on *Aëdes concolor*, Taylor, carried out in the Sydney district of New South Wales, where it

breeds only in rock pools (in which the salinity varies from 1 to 74 gm. salts per litre) at or slightly above high tide mark, both on the open coast and in sheltered estuaries. Investigations were undertaken in the laboratory in an attempt to determine from a study of this mosquito what factors limit mosquito larvae to particular types of breeding places.

The following is largely taken from the author's summary: *A. concolor* breeds mainly from October to April, and overwinters chiefly as a fourth-instar larva. The larvae feed mostly on organic detritus. Fertile eggs were deposited freely by females that had had no blood meal but had fed on fruit juice and were derived from larvae reared on a diet rich in protein and carbohydrate. Pairing took place readily in small cages, and unpaired females deposited numbers of non-fertile eggs. Large numbers of adults were reared from eggs, the only larval food being a finely powdered fish food, which consisted of oatmeal, wheat-meal, rice flour, dried prawns, dried eggs and meat meal, and contained 55·6 per cent. carbohydrate, 30·3 per cent. protein, 8·8 per cent. fat and 5·2 per cent. ash. The life-cycle from egg to egg varied from 28 to 39 days at temperatures of 70–80°F. Hibernating larvae lived for a maximum of 96 days, and unpaired females for a maximum of 108 days. The methods used in experiments on larval environment are described. The species will develop from egg to adult in tap water or in any dilution of sea-water with the addition of fish food. When the salinity of the water was gradually increased, adults were produced from sea-water with a salinity of 180 gm. salts per litre, and fourth-instar larvae lived for 5 days in sea-water containing 200 gm. salts per litre. Larvae in distilled water with fish food all died before the first moult, but *Culex fatigans*, Wied., was reared from egg to adult in this medium. *A. concolor* developed from egg to adult in artificial sea-water prepared from distilled water and pure chemicals, and in distilled water containing sodium chloride and calcium chloride in the proportions in which they are found in sea-water, but not in solutions of either salt separately. In each case fish food was added to the solution. Larvae can withstand abrupt changes of salinity of from 10 to 105 and from 105 to 10 gm. salts per litre. A physiological adaptation takes place in larvae gradually accustomed to increasing salinity. Females oviposited on distilled water in preference to clean filtered sea-water of a salinity of 35–50 gm. salts per litre.

Records of the salinity of the waters in which other species of Australian mosquitos breed are given, with notes on the relative sizes of the anal papillae [*cf. R.A.E.*, B **21** 74]. In the larvae of *A. concolor*, these are vestigial (or rudimentary).

The results of the field observations and laboratory experiments are discussed from the physiological and ecological aspects.

CAUCHI (J.), SELLERS (W.) & BUNKALL (J. D.). **A Method of testing Oils and other Chemical Agents for killing Mosquito Larvae.**—*Bull. ent. Res.* **27** pt. 4 pp. 649–652. London, December 1936.

The authors describe in detail a method for making comparative tests of mosquito larvicides under conditions as nearly natural as possible. Pits of identical size and shape are dug and kept under observation for mosquito breeding. The intensity of breeding in each pit is measured by a standard method of dipping and counting the larvae, and the

substances to be tested are applied in similar quantities in the same manner. The results are estimated either by dipping and counting again or by counting the numbers of adults caught in a trap at the top of the cage that is placed over each pit after the application of the larvicide.

THEODOR (O.). **On the Relation of *Phlebotomus papatasii* to the Temperature and Humidity of the Environment.**—*Bull. ent. Res.* **27** pt. 4 pp. 653–671, 16 figs., 10 refs. London, December 1936.

Details are given of experiments undertaken to study the thermal death points of *Phlebotomus papatasii*, Scop., the influence of temperature and humidity on the longevity of the adults, and the loss of water in larvae and pupae under different conditions. The following is based on the author's summary : With one hour's exposure, the upper thermal limit was 40·5°C. [104·9°F.] for unfed females, 41°C. [105·8°F.] for those that had fed, and 42°C. [107·6°F.] for males. With long exposures, fed females died at a lower temperature than unfed ones. Larvae died at 42°C. after one hour's exposure. Adults died in two hours at –5·5°C. [22·1°F.] and larvae in half an hour at –10°C. [14°F.]. The length of life at different temperatures and relative humidities ranged among unfed adults from 1·6 days at 30°C. [86°F.] and 0 per cent. humidity to 11·8 days at 15°C. [59°F.] and 95 per cent., and in fed flies from 2·8 to 12·1 days under the same two sets of conditions, respectively. The length of life increased with the rising humidity at each temperature. It was found that sandfly larvae and pupae have no protection against loss of water and die of desiccation in nearly saturated air if they have no contact with water. Larvae lose all water through their skins. Determination of fat content showed that fat constitutes 15 per cent. of the dry weight of hibernating larvae and only 5 per cent. of that of active ones. The weight of successive blood meals taken by sandflies is shown in a table. At 23°C. [73·4°F.] they took as many as six, but at 30°C. [86°F.] most of them died after taking only two.

RAMSAY (G. C.) & MACDONALD (G.). **The Species Control of Anophelines in India.**—*Indian med. Gaz.* **71** no. 12 pp. 699–710, 3 figs., 55 refs. Calcutta, December 1936.

The history of research on the vectors of malaria in India is briefly reviewed. Of the 43 species of Anophelines known to occur there, the 12 following have been found naturally infected with sporozoites : *Anopheles ramsayi*, Covell, *A. maculatus*, Theo., and *A. vagus*, Dön., which are considered to be unimportant as vectors of the disease, and *A. minimus*, Theo., *A. fluviatilis*, James, *A. varuna*, Iyen., *A. culicifacies*, Giles, *A. sundaicus*, Rdnw., *A. stephensi*, List., *A. philippinensis*, Ludl., *A. annularis*, Wulp, and *A. pallidus*, Theo., all of which may be of importance. Present knowledge on the bionomics of the last nine is summarised separately under each species, information being given on its distribution in India, the numbers dissected and found infected, the areas in which it acts as a vector, and its seasonal prevalence, types of breeding place, and feeding habits. In each case, suggestions based on these data are made for possible measures of

control, some of which have already been tried and found satisfactory. Attention is drawn to the fact that there are large areas in India where no infectivity surveys have been carried out and to the need for further work, both biological and systematic, on all these species except *A. minimus*, the only one on which the information is at all adequate.

Papers noticed by Title only.

[Derbeneva-Ukhova (V. P.).] **Дербенева-Ухова (В. П.). Einfluss der Temperatur auf die Wachstumsgeschwindigkeit der Fleischfliegen** *Phormia terrae-novae* **R. D. und** *Calliphora erythrocephala* **Meig.** [The Influence of Temperature on the Rapidity of the Growth of the Blowflies, *P. terraenovae* and *C. erythrocephala*.] [*In Russian.*]—*Med. Parasitol.* **5** no. 3 pp. 340–351, 7 graphs, 14 refs. Moscow, 1936. (With a Summary in German.) [For Summary see *R.A.E.*, B **23** 110.]

[Shipitzina (N. K.).] **Шипицина (Н. К.). The Mouth-Apparatus of the Mosquito Larvae. 1. Epipharynx of the Larvae of** *Anopheles* [*maculipennis* var. *messeae*, Flni.]. [*In Russian.*]—*Med. Parasitol.* **5** no. 3 pp. 352-362, 1 pl., 9 figs., 7 refs. Moscow, 1936. (With a Summary in English.)

Corradetti (A.). **I distomi parassiti dell'***Anopheles maculipennis.* [The Species of *Agamodistomum* parasitising *Anopheles maculipennis*, Mg., including *A. neurogangliorum*, sp. n., described from Italy.]—*Riv. Parassit.* **1** no. 1 pp. 39–51, 2 figs., 2 pls., 14 refs. Rome, January 1937. (With Summaries in English and German.)

Papadakis (A.). **Avian Malaria Parasites and their Incidence in Greek Birds.** [*In Greek.*]—*Prakt. Akad. Athen.* **10** pp. 432-436, 6 refs. Athens, 1935. (With a Summary in English.) [Recd. February 1937.]

Shannon (R. C.) & Hadjinicolaou (J.). **List of Tabanidae (Dipt.) of Greece.**—*Acta Inst. Mus. zool. Univ. Athen.* **1** fasc. 6–7, pp. 160–172, 20 refs. Athens, 1936.

Le Gac (P.). **Note sur la présence à Saint-Raphaël (Var.) de** *Phlebotomus perniciosus* **Newstead 1911.**—*Bull. Soc. Path. exot.* **29** no. 9 p. 966, 1 ref. Paris, 1936. **Sur trois phlébotomes capturés à Provins (Seine-et-Marne) pouvant être rapportés à** *Phlebotomus perniciosus* **Newstead 1911.**—*T.c.* pp. 966–970, 4 refs.

Gier (H. T.). **The Morphology and Behaviour of the intracellular Bacteroids of Roaches.**—*Biol. Bull.* **76** no. 3 pp. 433–452, 2 pls., 29 refs. Wood's Hole, Mass., December 1936.

Strickland (E. H.). **The Distribution of the Black Widow Spider** [*Latrodectus mactans*, F.] **in Alberta.**—*Canad. Ent.* **68** no. 12 pp. 284–285. Orillia, December 1936.

Jackson (R. B.). **Investigations into the Habits and Pathogenicity of the Anophelines met with in two Localities in Hong Kong during 1931–1935.**—*Chin. med. J.* **50** no. 8 pp. 1098–1113, 2 maps, 4 refs. Peiping, August 1936.

A detailed account is given of investigations on the Anopheline mosquitos of two areas on the Island of Hong Kong carried out during 1932–35. The following is taken largely from the author's summary: In the first area, practically the only larvae taken were those of *Anopheles maculatus*, Theo., which were abundant throughout it, and those of *A. minimus*, Theo., which were only numerous at certain seasons in some of the streams in one small section. In this section, the spleen rate was high and there were neither cattle nor pigs; in the rest of the area the spleen rate was low and cattle and pigs were numerous. No serious outbreak of malaria occurred among several hundred labourers who resided in the area for 2½ years. In the sheds occupied by the men, only a few examples of *A. minimus* were found, and these towards the end of each year when their larvae were most numerous; one was, however, infected. The results of precipitin tests indicated that *A. maculatus* was strongly attracted to cattle; examination of the salivary glands of 712 and the stomachs and salivary glands of 597 examples showed no malaria parasites, thus indicating that it is of no importance as a vector in this locality under present conditions, although it was found in the laboratory to be a good experimental vector of malignant tertian [*Plasmodium falciparum*].

In the second area, *A. minimus*, which was most readily taken in bamboo huts in the morning, was an important vector; the infection rate over a period of 4 years among 11,447 specimens dissected was 4·5 per cent., and infected examples were found in all the months of the year, although they were more numerous during the second six. *A. jeyporiensis* var. *candidiensis*, Koidz., which was also taken most readily in the morning, was scarce from April to September and most numerous from October to December. The infection rate was 3·31 per cent. among 544 specimens dissected. Larvae of this species were found in abundance in pools in rice stubble after the reaping of the second crop. Among 40 specimens of *A. tessellatus*, Theo., oöcysts were found in one taken in July, and among 383 specimens of *A. hyrcanus* var. *sinensis*, Wied., in one taken in October. Although larvae of *A. maculatus* and *A. hyrcanus* var. *sinensis* were abundant, adults were difficult to find; the best catches were made in pigsties in the evening. Brief notes are given on the infection of mosquitos in this locality with filarial larvae [see next paper].

Jackson (R. B.). **Some Observations on the Occurrence of Filarial Infection in Mosquito and Man in the Colony of Hong Kong.** —*Chin. med. J.* **50** no. 12 pp. 1767–1772, 4 refs. Peiping, December 1936.

In June 1932, in the course of dissecting mosquitos from a locality on the Island of Hong Kong for malaria parasites [see preceding paper], filarial larvae were seen in *Anopheles minimus*, Theo., and examination of blood subsequently obtained from 106 of the inhabitants revealed

microfilariae of *Filaria* (*Wuchereria*) *bancrofti* in 13. Further dissections during 1932–35 demonstrated filarial larvae in *A. jeyporiensis* var. *candidiensis*, Koidz., and *Culex fatigans*, Wied. In 10 females of *A. minimus* and 1 of *A. jeyporiensis* var. *candidiensis* infected with filariae, malaria parasites were also observed.

During 1934–35, dissections were also made of mosquitos caught in a labour camp on the mainland. Filarial larvae and malaria parasites were found in *A. minimus*, *A. jeyporiensis* var. *candidiensis*, *A. hyrcanus* var. *sinensis*, Wied., *A. maculatus*, Theo., and *A. splendidus*, Koidz.; mixed infections were seen in 8 females of the first species, 15 of the second and 1 of the fourth. Microfilariae were occasionally noticed in thick blood films from man in the course of examinations for malaria parasites. Filarial larvae in various stages of development were observed in the mosquitos, including sausage-shaped forms in the thorax and long motile forms in the thorax and head. Infection of the proboscis occurred in the first three species and in *Culex fatigans*. The larval filariae resembled those obtained from mosquitos fed experimentally on man. Diseases due to filarial infection do not appear to be common in the Colony of Hong Kong.

Reared examples of several species fed once (from 10 to 10.30 p.m.) on patients showing microfilariae in the blood were maintained on water and raisins and dissected 15 days later. Mosquitos that died or appeared likely to die earlier were also dissected. Larvae were found in *A. minimus* (4 out of 10), *A. hyrcanus* var. *sinensis* (6 out of 18), *A. maculatus* (4 out of 11), *C. fatigans* (11 out of 14), and *Aëdes togoi*, Theo. (32 out of 64). Proboscis infections were observed in the last four and fully developed forms in the head of *A. minimus*. No infection was seen in 8 females of *Aëdes albopictus*, Skuse.

CHUNG (Huei-Lan). **Studies on the Transmission of Relapsing Fever in North China. Preliminary Observations.**—*Chin. med. J.* **50** no. 12 pp. 1723–1734, 2 pls., 6 refs. Peiping, December 1936.

An outbreak of relapsing fever in a Chinese family in Peiping is described. Lice (*Pediculus humanus*, L.) taken from the clothing of the infected persons and from the body of one of them during remission of fever contained *Spirochaeta recurrentis*. The spirochaetes were found chiefly in the peritoneal cavity and legs; only a few were seen in the head and none in the stomach. They have been observed in the stomachs of lice taken on patients, but only when freshly ingested blood was present [*cf. R.A.E.*, B **25** 23]. Examination of lice for the presence of spirochaetes is suggested as an aid to diagnosis during afebrile periods. Injection of a suspension of the lice into splenectomised squirrels produced relapsing fever. The squirrels were also infected when blood containing spirochaetes was placed on the normal skin or mucous membranes. Bed-bugs (*Cimex lectularius*, L.) starved for 4–5 days and subsequently allowed to feed on a heavily infected squirrel became infected; numerous motile and infective spirochaetes were still present in them 25½ hours after feeding. *S. recurrentis* was also obtained from squirrel lice of an undetermined species from infected squirrels, and instillation of a suspension of two examples in the conjunctivae and oral mucosae of a splenectomised squirrel produced infection.

YAO (Y. T.), LING (L. C.) & LIU (K. B.). **Studies on the so-called** *Changch'i.* **I.** *Changch'i* **in Kweichow and Kwangsi Border.**—*Chin. med. J.* **50** no. 5 pp. 726–738, 4 figs., 10 refs. Peiping, May 1936.

LING (L. C.), LIU (K. B.) & YAO (Y. T.). **Studies on the so-called** *Changch'i.* **Part II.** *Changch'i* **in Yunnan.**—*T.c.* no. 12 pp. 1815–1828, 3 pls., 1 map, 14 refs. Peiping, December 1936.

An account is given of investigations on a disease known as "changch'i" that is prevalent in the mountainous regions of south-western China. In the localities surveyed, it proved to be malignant tertian malaria [*Plasmodium falciparum*], and the fact that the natives denied that it was malaria was due to their recognising only the benign form of the disease [*P. vivax*].

In the first paper, the authors describe their findings in Kweichow, where it occurs chiefly in the south and particularly in the valley of the Pan-kiang near the border of Kwangsi. Mosquitos were collected in the different villages visited, and a more detailed report on them will be made later.

In the second paper, an account is given of the investigation carried out in Yunnan between 10th November 1935 and 24th January 1936. The disease is widely distributed, but is most prevalent in the western, north-western and southern parts of the Province. It occurs most often in low-lying areas and in the wet season. It causes more sickness and more deaths than all other infectious diseases combined, and has retarded the economic development of the Province. The parasite index ranged from 7·66 to 68·17 and the spleen index from 12·05 to 100, the averages being 27·40 and 49·75, respectively. About 500 adults and 1,000 larvae of Anophelines were collected, belonging to the following species: *Anopheles hyrcanus* var. *sinensis*, Wied., *A. hyrcanus* var. *nigerrimus*, Giles, *A. philippinensis*, Ludl., *A. vagus*, Dön., *A. aitkeni*, James, *A. minimus*, Theo., *A. maculatus*, Theo., *A. jeyporiensis*, James, *A. barbirostris*, Wulp, and *A. kochi*, Dön. In one locality, *A. minimus* and *A. hyrcanus* var. *sinensis* were found in dwellings. Of 30 of the former dissected, one showed a stomach infection; of 9 of the latter, none was infected. When 2 of the former and 11 of the latter were fed on a man with malignant tertian gametocytes in the peripheral blood, oöcysts were found in one example of *A. hyrcanus* var. *sinensis* 11 days later. In another locality, *A. minimus* and *A. jeyporiensis* were most commonly taken in houses; 55 of the former and 53 of the latter were dissected, and oöcysts were found in 3 and 1, respectively.

FENG (Lan-chou). **Malaria and its Transmission in Kwangsi, China.**—*Chin. med. J.* **50** no. 12 pp. 1799–1814, 4 pls., 1 map, 13 refs. Peiping, December 1936.

Brief malaria and Anopheline surveys were carried out in various localities throughout the Province of Kwangsi in southern China during September and October 1935. Malaria was hyperendemic in some places and absent in others. In general, it was more prevalent in the mountainous regions than in the less hilly areas in the central part of the Province. In the former, numerous small hill streams and seepage water draining from the hill-sides form ideal breeding places for *Anopheles minimus*, Theo., and *A. jeyporiensis* var. *candidiensis*, Koidz. In one locality, where the spleen and parasite rates in children

reached 58 and 50 per cent., respectively, both larvae and adults of these two species were numerous, and dissections of adults caught in houses revealed heavy infections in the stomach and salivary glands of 6 out of 37 of *A. minimus*, a heavy stomach infection with some mature oöcysts in 2 out of 56 of *A. jeyporiensis* var. *candidiensis*, and a light stomach infection with no mature and some degenerated oöcysts in 1 out of 15 of *A. hyrcanus* var. *sinensis*, Wied. In the central part of the Province, ponds, rice-fields, pools and marshes are numerous, and *A. hyrcanus* var. *sinensis* usually breeds in them in large numbers. Dissections of 74 females of this species in a locality where more than half the population was infected with malaria gave negative results, and it seems probable that it is not an important vector in this region. *A. minimus* and *A. jeyporiensis* are normally scarce owing to the lack of suitable breeding places. The population in these areas of low endemicity is not immune, and the formation of breeding places suitable for malaria vectors by unusually heavy rainfall may be the cause of an epidemic, such as was observed in 1935 in a locality where malaria had formerly been rare.

In this Province, the cases of malaria to which the name "changch'i" is applied are not restricted to those caused by *Plasmodium falciparum* [see preceding abstract], for in one locality where "changch'i" was common, the only parasites found were *P. vivax* and *P. malariae*.

HICKS (E. P.) & DIWAN CHAND. **A Mosquito Survey of Karachi Air Port.**—*Rec. Malar. Surv. India* **6** no. 4 pp. 515–535, 1 map, 4 refs. Calcutta, December 1936.

A mosquito survey of Karachi Air Port was carried out in 1935, primarily to determine the prevalence of *Aëdes aegypti*, L., in view of the risk of introduction of yellow fever into India by air transport, but also to obtain information on Anophelines as a basis for malaria control measures. The topography, climate and soil conditions of the locality are discussed. A list is given of the mosquitos taken, their seasonal prevalence is shown in a table, and their sheltering and breeding places are described. There is no satisfactory evidence that *A. aegypti* breeds naturally in the air port (its absence is probably due to the provision of a piped water supply), but it has been shown that it can maintain itself if water is allowed to stand. It was constantly found in a locality from which the prevailing wind blows towards the air port. It is believed that it may establish itself when the population of the air port is increased, unless definite steps are taken to exclude it. *Culex fatigans*, Wied., which has been shown to transmit yellow fever in the laboratory [*R.A.E.*, B **21** 263], was found throughout the survey, but its epidemiological importance is doubtful, and if efficient measures are taken against other mosquitos, it also should disappear. The Anophelines found were *Anopheles stephensi*, List., *A. culicifacies*, Giles, *A. subpictus*, Grassi, and *A. pulcherrimus*, Theo., of which only the first two are known to be of importance in the transmission of malaria in India. Dissection of 104 females of *A. stephensi* and 4 of *A. culicifacies* revealed no infections, probably because the low rainfall prevented their breeding in sufficient numbers to cause an epidemic. The amount of malaria in 1935 was negligible, but there was evidence of a moderate incidence in recent years.

Detailed recommendations are made for the control of mosquito breeding, including permanent measures connected with the management of water supplies, and measures, chiefly drainage, for dealing with temporary accumulations of water during the rainy season. The absence of mosquito larvae in a spring was believed to be due to the introduction of a larvivorous fish, *Lebias dispar*, which is not known to have been previously used in India. It devours larvae eagerly and appears to be hardy ; it is reported to have been in the spring for at least 4 years, and to have increased in numbers without the stock being replenished. It is doubtful whether it is effective in wells.

MULLIGAN (H. W.) & MAJID (S. A.). **Some Notes on the Care, Transportation, and Use of *Gambusia affinis* under Indian Conditions.**—*Rec. Malar. Surv. India* **6** no. 4 pp. 537–547, 1 pl., 2 refs. Calcutta, December 1936.

In 1929, a stock of the top-feeding minnow, *Gambusia affinis*, was established at Karnal. Demands for supplies for use in Anopheline control work have increased to an enormous extent in recent years, and requests have been continually received for information on the care and use of these fish. The present paper has been prepared with a view to answering some of the commoner questions regarding their rearing, maintenance and transport under Indian conditions, and the types of mosquito breeding places in which they have proved most effective.

WATS (R. C.) & BILDERBECK (C. L.). **Some Experiments with "Entoray" Machine as an Anti-mosquito Measure.**—*Rec. Malar. Surv. India* **6** no. 4 pp. 549–555. Calcutta, December 1936.

SENIOR WHITE (R.), LAL (R. B.), ADHIKARI (A. K.) & SWAROOP (S.). **Some Experiments with an automatic Mosquito Catching Machine : The Entoray.**—*T.c.* pp. 595–629, 5 refs.

In both these papers, accounts are given of experiments to test the effectiveness of the "Entoray" machine in catching mosquitos. The apparatus consists of a mercury-vapour lamp, which emits ultra-violet rays and a bluish light, placed at the top of a hollow square pillar down which a current of air is sucked by a powerful electric fan in the base. The air passes through a wire gauze box in which all the insects attracted by the light and sucked down the pillar are trapped.

The tests described in the first paper were carried out in the Bombay docks between 27th September and 1st November 1935. Known numbers of mosquitos were released near the machine, in some cases only 10 yards away, and the machine was run for a whole night (10 hours) after each release. Out of 1,550 stained Culicine mosquitos only one was caught in 3 nights, but 185 unstained mosquitos from the local fauna were trapped. No attempt was made to estimate the density of the local mosquitos, but the number taken would appear to be insignificant. When 300 unstained Anophelines were released, 19 were caught in 10 hours, but some of these may have belonged to the local fauna. During the first two nights of the experiment, about 8,000 other insects, mostly beneficial, were caught. The authors conclude that the machine is of no practical value against mosquitos under the conditions of the experiment, but that research might discover a ray that will attract mosquitos.

In the first experiment described in the second paper, a machine caught 18,694 mosquitos in 81 hours in a virtually uncontrolled area of Calcutta, and 3,399 in 648 hours in a controlled area in the Calcutta docks, during February-March 1936. These mosquitos comprised 26 species of which 12 were Anophelines.

In the second experiment, designed to test the range of attractiveness, 3,292 stained laboratory-bred examples of *Culex fatigans*, Wied., were released at a distance of 500 yards and 3,320, stained with a different stain, at 100 yards. As previous work had shown that the machine caught the largest numbers of mosquitos in the first two hours after dark, it was worked from 6.30 p.m. to 8 p.m. for six nights. Only six of the former batch and one of the latter were recaptured.

In the third experiment, machines were placed in the neighbourhood of regular catching stations for which records were available for the past five years, or near a chosen spot where control catches were made. In comparisons of catches, only figures for *C. fatigans* were used, since this is the only species present in large numbers in Calcutta during the period of the experiment (February–March). It is concluded that the machine effected no significant reduction in the numbers of mosquitos. On the other hand, analyses of the catches provide interesting data on the incidence of species and suggest that the machine may be of distinct value in research work, particularly regarding the movements of mosquitos during hours of darkness.

The results of the statistical analysis of the data the second paper are shown in appendices.

RICE (E. M.) & MOHAN (B. N.). *A. minimus* **in Assam, its Cold Weather Bionomics and their Relationship to Anti-larval Control.**— *Rec. Malar. Surv. India* **6** no. 4 pp. 557–594, 1 graph, 16 refs. Calcutta, December 1936.

Since the senior author's observations on the habits of *Anopheles minimus*, Theo., in Assam during the cold months of the year [*cf.* *R.A.E.*, B **24** 79] were not in accord with those of other workers [*cf.* **18** 171, etc.], further investigations were undertaken between November 1935 and the end of March 1936 on a tea estate in the coldest part of the plains of Upper Assam where malaria is hyperendemic and the minimum temperatures are as low as, and often lower than, those experienced in other parts of the plains. These researches, which are described in the present paper, confirm his previous conclusions regarding the overwintering habits of *A. minimus* and the consequent necessity for commencing measures against the larvae early in January.

The following is taken from the authors' summary: Stream breeding experiments, with appropriate laboratory controls, showed that *A. minimus* does not remain in the larval stage throughout the winter [*cf.* **21** 227]. In spite of the low minimum temperatures experienced in the plains of Assam, a constant supply of adults is produced throughout the cold weather by continuous breeding. Studies of the wing grades [*cf.* **20** 280], ovarian development and gut contents of adults from December to March revealed no evidence of hibernation, overwintering or gonotrophic dissociation. Blood in different stages of digestion was detected in 96 per cent. of females caught at regular intervals and dissected on the day they were caught, and ovarian development, which must have been dependent on blood feeds, had continued uninterruptedly in 1,122 females dissected 8–18 days after they were

taken, so that it would appear that the feeding stimulus is not inhibited by the minimum temperature prevailing when suitable micro-climates are available. There is no evidence to support the view that infected or uninfected adults are carried over from November to act as vectors in March. The oöcyst rates for December–March, inclusive, were 4·8, 2, 2·1 and 8·6 per cent., respectively, and the corresponding sporozoite rates were 1·8, 0·3, 0 and 2·6 per cent. The main factors that are considered responsible for reduction in the amount of transmission during January and February, when the mean temperatures are below 60°F., are the relatively short life of the vector and the relatively long time required by the parasite to reach the infective stage.

These findings indicate that anti-larval measures should be begun not later than 15th January if they are to be effective in preventing the annual rise in the number of cases of malaria in March–April in the plains of Assam. The adults that emerge in January and February are sufficiently numerous to be responsible for active transmission in March after the mean temperature has become high enough to allow the parasite to reach the sporozoite stage.

PRASHAD (B.) & HORA (S. L.). **A general Review of the probable Larvivorous Fishes of India.**—*Rec. Malar. Surv. India* **6** no. 4 pp. 631–648, 7 pls., 36 refs. Calcutta, December 1936.

The literature on the Indian fish that feed on mosquito larvae is briefly reviewed, the question of the value of these fish and of two exotic species in the destruction of mosquito larvae is discussed, and suggestions are made as to the lines along which future work should be carried out to determine definitely the relative utility of various indigenous species as larvicidal agents. It is pointed out that herbivorous fish might be used to destroy mosquito larvae indirectly by removing the vegetation on which they depend for nourishment.

EBDEN (J. A. W.) & SATYANARAYANA (K.). **A brief Report on the Mosquito Control Work in Vizagapatam Port (Abstract).**—*Rec. Malar. Surv. India* **6** no. 4 pp. 649–650. Calcutta, December 1936.

Special observations on the occurrence of mosquitos of the genus *Aëdes* have been made in and around the Port of Vizagapatam since December 1935, and *A. aegypti*, L., *A. albopictus*, Skuse, and *A. vittatus*, Big., have been found breeding there. The actual and potential breeding places were suitably dealt with. Of 182 adult mosquitos taken in a number of catching stations in the industrial area of the Port between 8th December 1935 and 30th June 1936, only 19 were species of *Aëdes*. Almost every ship visiting the port was examined for mosquitos, but in only one were any found (on 8th December 1935) ; these comprised 1 pupa of *A. aegypti* and 10 adult Culicines not belonging to the genus *Aëdes*.

A study of the algae in 17 Anopheline breeding places showed that *Spirogyra* was the predominating form in most of them and that *Chlamydomonas* was the next commonest. The introduction of *Gambusia* into a well in which *Anopheles culicifacies*, Giles, and *A. stephensi*, List., were breeding in large numbers gave satisfactory results.

Strickland (C.). **Papers on Malaria in Malaya.**—*Meded. Dienst Volksgezondh. Ned.-Ind.* **25** no. 3 pp. 331–340, 4 pls., 10 refs. Batavia, 1936.

In this paper are recorded the results of an investigation of belts of mangrove made several years ago in the Federated Malay States but hitherto unpublished. These belts occur on alluvial land flooded at times with salt or brackish water, and it was commonly supposed that Anophelines bred in them and that they were associated with malaria. In the author's investigation, however, which was made in mangrove belts of all types, including those flooded only when the tide is abnormally high, no Anopheline larvae or adults were found. Furthermore, no evidence of malaria was found in settlements established in areas surrounded by mangroves. The characteristics of the different types of belts are discussed in some detail.

Corson (J. F.). **Experimental Transmission of** *Trypanosoma gambiense* **by** *Glossina morsitans* **through Monkeys.**—*Ann. trop. Med. Parasit.* **30** no. 4 pp. 389–400, 5 refs. Liverpool, 23rd December 1936.

The relation between *Trypanosoma gambiense* and *T. rhodesiense* is still unknown, and it was thought that information on the subject might be obtained by a study of each trypanosome after repeated transmission by the species of *Glossina* that is usually the vector of the other. In the present paper, the author describes in detail experiments in which a strain of *T. gambiense* from Uganda was transmitted by *Glossina morsitans*, Westw., bred in the laboratory, through a series of monkeys (*Cercopithecus*) over a period of 21 months (from September 1934 to May 1936). So far as could be judged by the course of infection in the monkeys and by the results of inoculations of laboratory animals, no increase in virulence took place during the eight passages.

Foy (H.) & Kondi (A.). **Researches on Blackwater Fever in Greece. IV.—Experimental Investigation into the Existence of Haemolytic Strains of Malaria and/or other Specific Parasites in Blackwater Fever.**—*Ann. trop. Med. Parasit.* **30** no. 4 pp. 423–433, 3 refs. Liverpool, 23rd December 1936.

Females of *Anopheles sacharovi*, Favr (*elutus*, Edw.), *A. superpictus*, Grassi, and *A. maculipennis*, Mg., were fed on 35 different cases of blackwater fever after the lapse of varying periods of time from the first passage of urine containing haemoglobin, and fed again after different periods of incubation at 26°C. [78·8°F.] on 68 cases of general paralysis, but none of the latter acquired blackwater fever. Various experiments in blood inoculation also failed to transmit the disease. These findings would appear to limit the field of argument for the existence of haemolytic strains of malaria or other specific parasites concerned in the genesis of blackwater fever.

Patton (W. S.). **Studies on the Higher Diptera of Medical and Veterinary Importance. The Warble Flies of the Genus** *Hypoderma.*—*Ann. trop. Med. Parasit.* **30** no. 4 pp. 453–468, 12 figs., 17 refs. Liverpool, 23rd December 1936.

The author illustrates the male and female terminalia of *Hypoderma lineatum*, Vill., *H. diana*, Brauer, *H.* (*Oedemagena*) *tarandi*, L., *H. crossi*, Patt., and *H. aeratum*, Aust., and gives brief descriptions of the

adults and some notes on the life-histories of these species and of *H. bovis*, DeG. [*cf. R.A.E.*, B **23** 296]. From a study of the gradations in the characters in these six species, he concludes that the genus *Oedemagena*, erected for *H. tarandi*, is not distinct from *Hypoderma*.

Blacklock (D. B.). **Studies in Rural Hygiene in the Tropics. III.—Simple Forms of Subsurface Drainage for Anti-malaria Work.**—*Ann. trop. Med. Parasit.* **30** no. 4 pp. 501–510, 2 pls., 1 ref. Liverpool, 23rd December 1936.

The author points out that in most rural areas of tropical or subtropical countries it is economically impracticable to use manufactured piping for subsurface drainage. He therefore describes various means for the prevention of Anopheline breeding that make use of material that can be obtained cheaply on or near the spot. They comprise bamboo drains [*cf. R.A.E.*, B **22** 177; **23** 92], stick and fascine drains [**22** 149], herbage cover [**25** 46], a form of vertical drainage (percolation pits), in which the water to be disposed of is led by drains to pits dug through the soil to a permeable stratum beneath (these pits have also been used successfully in the beds of streams), and drains constructed of local stone, in which a tunnel formed of two parallel rows of stones roofed with flat stones is laid in a graded trench and covered successively with large stones, smaller stones and finally gravel or porous soil up to the ground level. These stone drains may be laid in ordinary earth drains, and may have grass planted on the top if the depth of the drain is sufficient to prevent blocking by grass roots; or they may be used in ravines where the stream runs in an irregular rocky bed. In the latter case the bottom of the ravine is roughly straightened, several tunnels are made side by side, and if, as is usual, there is plenty of depth, large stones only may be used for building the drain up to the desired height, and the top may be composed of large flat stones to make a good surface for walking. As a result of observation and experiment, Williamson concludes that Anophelines do not penetrate down into the crevices between even large stones to a depth greater than about a foot.

Evans (A. M.). **Preliminary Records of Larvae of the** ***funestus*** **Series collected in Kenya by Mr. C. B. Symes.**—*Ann. trop. Med. Parasit.* **30** no. 1 p. 131. Liverpool, 8th April 1936.

Evans (A. M.) & Garnham (P. C. C.). **The** ***funestus*** **Series of** ***Anopheles*** **at Kisumu and a coastal Locality in Kenya.**—*T.c.* no. 4 pp. 511–520, 1 pl., 1 fig., 6 refs. Liverpool, 23rd December 1936.

In the first paper are given briefly the results of the examination of larvae of the series of *Anopheles funestus*, Giles, sent from Kenya by C. B. Symes. The 16 collections from 11 different localities comprised typical *A. funestus*, which was the predominating form, *A. funestus* var. *rivulorum*, Leeson, and *A. leesoni*, Evans, which occurred in three localities, and *A. funestus* var. *confusus*, Evans & Leeson, of which only a single specimen was received.

In the second paper are recorded the results of observations made on the same series of Anophelines in Kenya. An examination of forms of *A. funestus* var. *rivulorum* from Southern Rhodesia and from Kisumu and Digo in Kenya leads the authors to conclude that this variety should be raised to specific rank. The Kisumu form is closely

associated in its breeding places with *Pistia stratiotes* and appears to represent a distinct biological form; it is also distinguished by certain minor differences, particularly in the pupal stage. As these differences concern characters that vary in one or more of the forms, they are not considered to be of varietal value. The eggs of this form are described. The adults do not frequent houses, and it is unlikely that they are of importance in the transmission of malaria. The form from the Digo district on the coast resembles the Rhodesian form more closely in the early stages than does the Kisumu form. The typical form of *A. funestus* was by far the most common member of the series in both localities and, in Kisumu at least, was the only one found in human habitations. Larvae were found in a swamp among a dense growth of *Chara*, and in association with those of *A. rivulorum* among bladderwort (*Utricularia*); under artificial conditions the latter plant caught several larvae, though none was found in the bladder in nature.

Evans (A. M.). **Two new Anopheline Mosquitoes from Kenya.**—*Ann. trop. Med. Parasit.* **30** no. 4 pp. 533–540, 3 figs. Liverpool, 23rd December 1936.

The author describes the larva, pupa and adults of both sexes of *Anopheles* (*Myzomyia*) *harperi*, sp. n., and *A.* (*M.*) *macmahoni*, sp. n., from Kenya. Numerous larvae of the former were taken in a backwater near a dam, in shallow water with standing grass shaded by trees and bushes and separated by tall reeds from the rest of the reservoir behind the dam, where larvae of *A. funestus*, Giles, were found.

Archibald (Sir R. G.) & Mansour (H.). **Some Observations on the Epidemiology of Kala-azar in the Sudan.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 4 pp. 395–406, 4 refs. London, 26th January 1937.

In the course of this paper on visceral leishmaniasis in man in the Anglo-Egyptian Sudan, the authors point out that the disease is endemic, is present only in districts where the minimum annual rainfall is 10 inches, and occurs from July to October. Arthropods collected during and after the rainy season in huts where cases had been found included *Phlebotomus papatasii*, Scop., *P. squamipleuris*, Newst., *P. perniciosus*, Newst., *P. minutus*, Rond., *P. africanus*, Newst., *Anopheles gambiae*, Giles, *Musca domestica*, L., *Cimex lectularius*, L., *C. hemiptera*, F. (*rotundatus*, Sign.), *Pediculus humanus*, L. (*vestimenti*, Nitzsch), and *Argas persicus*, Oken. Dissections of these Arthropods revealed no developmental or other forms of *Leishmania*, and examination of sandflies from the kala-azar ward of a hospital also gave negative results. Plant bugs, mainly *Lygaeus militaris*, F., and *Aspongopus viduatus*, F., were infested with herpetomonad flagellates, which were proved by inoculation into monkeys to be non-pathogenic.

De Verteuil (E. J.) & Spence (T.). **Malaria in Trinidad. Low Tide Level Culvert System in Coastal Drainage.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 4 pp. 449–460, 2 pls., 1 fig., 4 refs. London, 26th January 1937.

The authors give a brief outline of the factors (chiefly an improved standard of life and agricultural conditions) that have led to a decrease

in the incidence of malaria in Trinidad. Recent surveys have shown that of 13 species of Anophelines, only two are important vectors, *Anopheles tarsimaculatus*, Goeldi [*cf. R.A.E.*, B **20** 267; **22** 29] and *A. bellator* var. *cruzi*, D. & K.

The latter is essentially a forest mosquito and is found in numbers in the hilly inland parts of the Island where the rainfall is sufficient to maintain a prolific growth of bromeliads, which are parasitic on the trunks and branches of the forest trees and hold sufficient water at the base of their leaves to permit extensive breeding during the rainy season. It bites freely during the day in the shade of the forest, but is especially active in the evening. There are no large human populations in the forest, and it cannot be of great importance in transmission there, but over large sections of the Island the forests have been cut down and replaced by cacao estates. The shade tree planted is the immortelle [*Erythrina*], which harbours enormous numbers of bromeliads (in some instances as many as 500–1,000 per tree), and the villages that have usually grown up round these estates are consequently infested with *A. bellator* var. *cruzi*, which has become a dangerous vector and is probably responsible for about 20 per cent. of the mortality from malaria. It occurs in large numbers for a period of about 6–8 weeks during June–August, and is commonly caught in yards, sheds, stables, outhouses, etc.; it enters houses, but to a much more limited extent. Transmission appears to take place almost entirely outside houses. The breeding places of *A. tarsimaculatus* are briefly discussed, and the necessity for taking measures to eliminate breeding in swamps and the mouths of rivers is emphasised.

In an appendix, a description is given of a system of culverts (furnished with sluice gates and running from the swamps or rivers to the sea at low tide level) that is being used with success for the draining and flooding of swamps and the draining of the mouths of rivers that are liable to become choked with sandbanks [*cf.* **22** 30].

JOBLING (B.). **The Development of Mosquitoes in complete Darkness.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 4 pp. 467–474, 2 figs., 1 ref. London, 26th January 1937.

The author describes in detail a light-proof apparatus in which experiments were made to determine whether mosquitos can develop in complete darkness [*cf. R.A.E.*, B **23** 263]. The results show that in this apparatus *Aëdes aegypti*, L. (*argenteus*, Poir.), *Culex fatigans*, Wied., and autogenous and non-autogenous races of *C. pipiens*, L., can develop from egg to adult, the first three can oviposit, and the autogenous race of *C. pipiens* can produce a second generation.

GEBERT (S.). **Notes on Filariasis and its Transmission by Mauritian Anophelines.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 4 pp. 477–480, 2 refs. London, 26th January 1937.

Examination of blood films of 1,683 persons admitted to hospital showed that the percentages of men and women infected with *Filaria* (*Wuchereria*) *bancrofti* were 9·1 and 3, respectively, in Port Louis, and 11·6 and 3·1 in other districts of Mauritius. When the places of origin of the town cases were marked on a plan, it was found that they were invariably in the vicinity of streams or open drains. The figures so far obtained indicate that filariasis is well established throughout the

Island. The season of the year appears to influence the occurrence of microfilariae in the peripheral blood; they are generally more numerous in the cool weather, and the rate of transmission is higher in winter in the coastal belt where the temperature does not fall low enough to produce a decrease in the number of Anophelines.

In experiments in which reared examples of *Anopheles gambiae*, Giles (*costalis*, Theo.), *A. funestus*, Giles, *A. maculipalpis*, Giles, and *A. coustani*, Lav. (*mauritianus*, Grp.) were fed on infected persons and subsequently dissected, the microfilariae completed their development in 16 days in the first two species and in 19 days in the third, but only two out of 13 examples of the fourth showed embryos that had reached the thickened stage, and in one these had died and were degenerating. It is concluded that the first three species may act as vectors.

FREY (R.) & others. **Die Dipterenfauna der Kanarischen Inseln und ihre Probleme.**—*Comment. biol.* **6** no. 1 pp. 1–237, 12 pls., 4 graphs, 4 pp. refs. Helsingfors, February 1936. [Recd. 1937].

This is a survey of the Diptera of the Canary Islands, including a discussion of their distribution and descriptions of many new species. The mosquitos, which are dealt with by R. Storå, comprise *Culex pipiens*, L., *Aëdes caspius*, Pall., *A. detritus*, Hal., *A. aegypti*, L. (*fasciatus*, F.), and *Anopheles superpictus*, Grassi.

[DRYENSKI (K.).] **Дрѣнски (К.). The Influence of intermittent and regular Irrigation of the Rice-field upon Malaria and the Rice Produce.** [*In Bulgarian.*]—*Mitt. bulg. ent. Ges.* **9** pp. 11–24, 1 map, 3 refs. Sofia, 1936. (With a Summary in English.)

The value of interrupted irrigation of rice-fields for the control of Anophelines in Bulgaria [*cf. R.A.E.*, B **22** 52] was confirmed in further experiments carried out in 1933 and 1934 in the Strumitza valley, where the fields are kept constantly under water and *Anopheles maculipennis*, Mg., breeds profusely in them. Comparisons were made between a selected area, in which the ground was levelled before planting the rice and interrupted irrigation was tested, and a control area in which the usual conditions were maintained. From 15th April to 25th September, the fields in the experimental area were drained for 5–8 days at 10-day intervals; if larvae were present in small pools of water that sometimes remained, they were dusted with Paris green. Inspections showed that though larvae of the first two or three instars were present on the tenth day of irrigation, all were killed in the period of draining that followed. Mosquitos were collected throughout the year in equal numbers of houses and cow-sheds in villages in the treated and control areas; the respective numbers taken were 468 and 3,831 in 1933 and 1,253 and 7,301 in 1934. Furthermore, the numbers of cases of acute malaria in the two years were 29 and 63 in the village adjoining the treated rice-fields, as compared with 336 and 351 in the control village. The condition and yield of the rice were much improved in the treated fields, probably because all the rice plants were evenly and simultaneously covered with water owing to the levelling of the ground, and because of the desiccation of weeds and parasitic vegetation during the draining periods.

PANTAZIS (G.). **Les effets de la salinité de l'eau sur les larves des Culicines.**—*Prakt. Acad. Athen.* **10** no. 7 pp. 348–356, 4 refs. Athens, 1935. (With a Summary in Greek.) [Recd. 1937.]

An account is given of laboratory experiments to ascertain the effect on mosquito larvae of differences in the salinity of the water in which they were reared. It was found that the optimum solution of sodium chloride for *Aëdes mariae*, Ed. & Et. Serg. (*zammittii*, Theo.) was 20–30 per mille. The larvae hardly developed at all in solutions containing less than 1 or more than 75 per mille. The optimum solution for *A. caspius*, Pall., was 1–5 and the fatal solution 70–75 per mille. For *A. aegypti*, L., the optimum was 0·5–1 per mille and no development occurred in solutions stronger than 5 per mille. Salinity delayed hatching of the eggs of this species, but accelerated subsequent development.

The optimum solution for *Anopheles sacharovi*, Favr, was 5 per mille. The eggs did not hatch in solutions stronger than 20 per mille, but if they had hatched in a weaker solution and the evaporating water was not renewed, the larvae could support a resulting salinity up to 45 per mille. In the case of *A. maculipennis*, Mg., the optimum solution was 2 per mille for a race with dark banded eggs, and 1 per mille for a race with light banded eggs. Adults of the former, but not of the latter, were obtained from a 10 per mille solution.

[GORODETZKIĬ (A. S.) & SUKHOVA (M. N.).] **Городецкий (А. С.) и Сухова (М. Н.). Nouveaux poisons pour la destruction des stades préimaginales des mouches.** [*In Russian.*]—*Med. Parasitol.* **5** no. 3 pp. 303–323, 12 refs. Moscow, 1936. (With a Summary in French.)

A detailed account is given of experiments in the Ukraine with various chemicals against the immature stages of *Musca domestica*, L., and *Phormia terraenovae*, R.-D. (*groenlandica*, Zett.) in manure and heaps of refuse. The chemicals tested were paradichlorobenzene, chloropicrin, naphthocreolin, which is a by-product of the coke-chemical industry, and polychlorides, light hydrocarbons, and residue from the stills, which are waste products of the aniline industry. The polychlorides contained 9·33 per cent. benzene, 34·82 per cent. chlorobenzene and 36·56 per cent. paradichlorobenzene, and the residue from the stills contained 21·15 per cent. chlorobenzene and 69·65 per cent. paradichlorobenzene. Laboratory experiments were made in flower-pots filled with horse-dung or refuse and artificially infested with larvae and sometimes with eggs or pupae. In most cases, some of the larvae could not be found, alive or dead, at the end of the test; these are assumed to have migrated. All eggs, larvae and pupae were dead in 24 hours after light hydrocarbons or the residue from the stills was poured on the surface of the dung or refuse at the rate of 0·1 cc. per sq. cm. In the case of the light hydrocarbons, however, 60 per cent. of the larvae had migrated. Special tests showed that the breeding medium once treated with residue from the stills remains poisonous to the larvae of *M. domestica* for a whole month, but many of them migrated, particularly towards the end of the tests. Injecting the residue into the breeding medium was considerably less effective. Polychlorides were effective, but the rate of application required (over 0·32 cc. per sq. cm.)

would render them unsuitable for practical use. Paradichlorobenzene crystals, introduced at the rate of 0·05 gm. per sq. cm. into the centre of the pot at a depth of 1 cm., killed all the larvae and pupae of *M. domestica* in dung and almost all in refuse ; up to 16 per cent. of the larvae migrated. A 20 per cent. solution of paradichlorobenzene applied at the rate of 0·25 cc. per sq. cm. killed all the larvae remaining in both dung and refuse in 24 hours, but proved to be a strong repellent, 47·3 and 60·5 per cent., respectively, migrating. Naphthocreolin at the rate of 0·3 cc. per sq. cm. killed 98·7–99·4 per cent. of the larvae of *M. domestica* in a fortnight, only 1·5 per cent. having migrated, and a 5 per cent. emulsion of naphthocreolin in water at the rate of 1·6 cc. per sq. cm. was also very effective, as it killed practically all the larvae in 24 hours and only 9·5 per cent. had migrated. Chloropicrin, 0·03 cc. per sq. cm., gave almost a complete mortality of the larvae and pupae of *M. domestica* on the second day after the treatment ; special experiments showed, however, that its toxic effect lasted only half as long as that of the residue from the stills. In all tests, mortality was higher in the dung than in the refuse, probably because the poison does not penetrate into the folds of paper, rags, etc., where the larvae and pupae shelter. The percentages of larvae migrating increased as smaller amounts of the poisons were used, which showed that they act as repellents.

In field tests, all the eggs, larvae and pupae of the flies in a refuse heap were killed when the residue from the stills was applied at the rate of 4·8 pints per sq. yd., the toxic effect lasting for at least 20 days. It was, however, found possible to decrease the rate of application to 1·6 pints on fermenting refuse or manure in which the temperature was high, using 4·8 pints on the area round the heap to prevent the migration of the larvae. The best results with chloropicrin were obtained when it was applied at the rate of 7·8 fl. oz. per sq. yd. in small containers covered with wire gauze and buried in the refuse at a depth of 10 ins. and not more than 8 ins. apart. Chloropicrin was, however, relatively ineffective when the refuse or manure was very moist. The 5 per cent. emulsion of naphthocreolin killed all the larvae and pupae, only 0·9 per cent. of the latter surviving on the 17th day after the treatment. Paradichlorobenzene applied at the rate of 30 oz. per sq. yd. killed 95·7 per cent. of the larvae and pupae in two days. Light hydrocarbons were not available for tests in the field.

[Gorodetzkiĭ (A. S.) & Sukhova (M. N.).] **Городецкий (А. С.) и Сухова (М. Н.). Les dépôts de fumier et les caisses à ordures comme pièges pour les larves des mouches.** [*In Russian.*]—*Med. Parasitol.* **5** no. 3 pp. 324–328. Moscow, 1936. (With a Summary in French.)

Experiments were carried out in the Ukraine to devise a simple method of storing manure so that larvae of *Musca domestica*, L., maturing in it would be killed. Infested refuse and manure were placed in large covered wooden boxes, supported on legs 4 ins. high and having a bottom of wire netting. The soil under and close to the boxes was sprinkled with residue from the stills [see preceding paper] at the rate of 3·2 pints per sq. yard. Ten days later, there were a few live pupae in the boxes and an enormous number of dead larvae on the ground. A box would not be necessary in practice, as the manure could be heaped on any suitable grating supported 4 ins. above the

soil, which should be sprinkled once every 10 days. The layer of manure should not be too thick, as otherwise the larvae do not penetrate to the bottom of it readily. A subsidiary experiment indicated that if the insecticide used for soil treatment has repellent properties, the larvae may pupate in the manure if it is heaped on the soil instead of on a grating.

[KUZINA (O. S.).] **Кузина (О. С.). Fertilität und präimaginale Mortalität bei** *Musca domestica* **L.** [Fecundity and preadult Mortality in *M. domestica*.] [*In Russian*.]—*Med. Parasitol.* **5** no. 3 pp. 329–339, 9 graphs, 20 refs. Moscow, 1936. (With a Summary in German.)

Experiments on the reproductive power and mortality of *Musca domestica*, L., were carried out in Moscow in 1935. Some of them were made in January in the laboratory at a temperature of 25°C. [77°F.] and a relative humidity of 45–50 per cent., and others in July–September in an insectary under the conditions of temperature and humidity prevalent in the open. The adults were fed on milk and the larvae reared on horse dung [*cf. R.A.E.*, B **24** 72]. In the laboratory, the eggs hatched in 10–12 hours, and the larval and pupal stages lasted 4–11 and 5–10 days, respectively ; in the insectary, the corresponding periods were 1, 7–39 and 12–32 days. In the laboratory, the females began to oviposit a week after emergence, lived for 11–33 days, and usually laid 4–6 batches of 52–186 eggs. They lived longer (up to 68 days at 16–21°C. [60·8–69·8F.]) in wire cages than in the tumblers in which they were kept for oviposition. In the insectary, where the temperature was not constant, oviposition usually began on the 10th–12th day, the flies seldom laid more than 2 batches of eggs, the second 2–16 days after the first, and the number of eggs in a batch varied from 42 to 146. Counts of eggs laid at 25°C. by females taken in stables at different dates in August and September indicated that fertility increases towards the end of the season.

Experiments in which different numbers of larvae were reared on small pieces of liver showed that insufficient nutrition reduces the weight of the resulting pupae and the size and fertility of the adults. In the normal rearing experiments, the percentages of mortality of the eggs, larvae and pupae were, respectively, 2·23, 17·73 and 8·65 in the laboratory, and 11·33, 20·58 and 17·60 in the insectary. Larval mortality in the laboratory was confined to the first instar.

[BEKLEMISHEV (V.), VINOGRADSKAYA (O.), IVANOVA (L.) & SHIPITZINA (N.).] **Беклемишев (В.), Виноградская (О.), Иванова (Л.) и Шипицина (Н.). Sur l'élevage de l'***Anopheles maculipennis atroparvus* **v. Thiel au laboratoire.** [*In Russian*.]—*Med. Parasitol.* **5** no. 3 pp. 363–366, 8 refs. Moscow, 1936. (With a Summary in French.)

Starting with females obtained from southern Russia, where they had been collected in a cow-shed in September 1935, four generations of *Anopheles maculipennis* var. *atroparvus*, van Thiel, were reared in the laboratory in Moscow between October and March. The technique used is described ; a humidity of 80–90 per cent. was maintained, the temperature varied from 13·2 to 22°C. [55·76–71·6°F.], with an average

of about 18°C. [64·4°F.], and the mosquitos were fed on rabbits. Pairing took place on the walls of the cage, which was of cubical shape, with sides measuring 40 inches. Most of the initial females did not oviposit, though they fed and digested blood, being in the state of gonotrophic dissociation [*R.A.E.*, B **18** 53]. These females were transferred for hibernation to a cellar, where the humidity varied from 70·3 to 80·3 per cent. and the temperature from 8·5 to 13·3°C. [47·3–55·94°F.], and some of them continued to feed there. In the case of females that laid eggs, the first oviposition took place on 19th October, 11 days after engorgement ; the adults of the successive laboratory generations appeared on 13th November, from 20th December to 9th February, from 29th January to 21st March, and on 10th March. In all cases, the period between the emergence of the first adults and the first oviposition was 17–18 days.

Though the colony was reared from females about to hibernate, practically no cases of gonotrophic dissociation were observed in any of the generations that developed, with the exception of a few individuals of the first generation. This indicates that the winter condition in *A. maculipennis* var. *atroparvus* is due to the influence of external factors, possibly cold.

[Shipova (A. A.).] **Шипова (А. А.). Experiments on the Feeding of** *Anopheles maculipennis messeae* **Fall. in Winter.** [*In Russian.*]—*Med. Parasitol.* **5** no. 3 pp. 367–369. Moscow, 1936.

An account is given of experiments in the winter of 1934–35 with females of *Anopheles maculipennis* var. *messeae*, Flni., collected in Tomsk (western Siberia) from typical hibernation quarters in basements where the temperature varied from −2° to 7°C. [28·4–44·6°F.]. Even as early as November, fat-body was absent in 1 per cent. of the mosquitos and only partly developed in 19 per cent., so that they required supplementary feeding ; the percentage of such individuals increased in December. The mosquitos were given the opportunity to feed on the arm of man, but only a few engorged. Some of these were kept at 26°C. [78·8°F.] or at 10–14°C. [50–57·2°F.], and given sugar syrup for supplementary feeding, and about 18 per cent. of them oviposited. It is considered unlikely, however, that supplementary feeding or reproductive activity would occur at the normal low temperatures in the hibernation quarters.

Zvyagintzev (S. N.) & Demina (N. A.).] **Звягинцев (С. Н.) и Демина (Н. А.). Precipitin Test with the Stomachs of** *Anopheles maculipennis* **collected in the Environs of Saratov.** [*In Russian.*]—*Med. Parasitol.* **5** no. 3 pp. 370–378, 1 fig., 7 refs. Moscow, 1936.

In the summer of 1934, females of *Anopheles maculipennis*, Mg., were collected near Saratov from stables, cow-sheds, pig-sties and houses, the temperature in all these buildings varying from 19·5 to 29·6°C. [67·1–85·28°F.] and the humidity from 36 to 70 per cent. They were much more abundant in animal quarters than in dwellings. Examination of the eggs laid in captivity by mosquitos from stables and dwellings showed that the races to which they belonged were *maculipennis* (*typicus*) and *messeae*, Flni. Precipitin tests showed

that, when positive results were obtained, 94·66 per cent. of the mosquitos taken in inhabited houses had fed on man, and 88·43–95·83 per cent. of those taken in animal quarters had fed on the animal in the shed in which they were found. It thus appeared that the mosquitos usually shelter in the place in which they have fed ; in most cases both animal quarters and houses were built of wood, and were semi-dark, free from draughts and not much heated by the sun at noon.

[BUDUIMKO (F. S.).] **Будымко (Ф. С.). La lutte contre le paludisme dans les régions de pisciculture.** [*In Russian.*]—*Med. Parasitol.* **5** no. 3 pp. 394–400, 1 graph. Moscow, 1936. (With a Summary in French.)

Following an increase in the amount of malaria in the North Caucasus, especially among men engaged in fish breeding, experiments in the control of Anopheline larvae by dusting with Paris green were carried out from 13th August to 1st September 1933 in some of the fish ponds that occupy an area of over 3 sq. miles in the western part of the country. The larvae were exceedingly abundant in numerous borrow pits and ponds to which the fish are transferred for the winter. The breeding ponds stocked with fish were chiefly infested at the inlet, where the water was shallow and warmed by the sun ; in the main part of the pond most of the larvae were apparently destroyed by the fish before they completed development. Thus, the principal requirement for Anopheline control is the elimination of the breeding places that do not contain fish, but it will probably also be necessary to treat the fish ponds with Paris green. In the experiments, the Paris green was mixed with road dust and applied at the rate of 0·1 gm. per sq. m., and 74·5 per cent. of the larvae were killed. The fish were not affected even when the treatment was repeated.

[RUKAVISHNIKOV (B. I.).] **Рукавишников (Б. И.). Scorching of cultivated Plants by Dusts applied by Aeroplane for the Control of the Larvae of Malaria Mosquitos.** [*In Russian.*]—*Med. Parasitol.* **5** no. 3 pp. 426–437, 28 refs. Moscow, 1936.

In the Russian Union, serious injury to rice is sometimes caused by arsenical dusts applied from aeroplanes for the control of Anopheline larvae. Since this is due to incorrect application, the author gives a general review of the factors concerned in the scorching of plants by dust insecticides and points out that it depends primarily on their solubility and so, to a great extent, on humidity and the presence of dew. Experiments in dusting against Anopheline larvae in various countries have shown that rice is not injured by the application of 1–5 per cent. mixtures of Paris green at the rate of about 1 lb. per acre [*R.A.E.*, B **14** 126 ; **15** 4 ; **19** 74 ; **23** 217], and this has been confirmed by dusting rice-fields from aeroplanes in Central Asia and Transcaucasia. Cases of serious scorching of rice in the northern Caucasus and Kazakstan were due to uneven distribution of the poison. The causes of this included allowing the dust to become damp and form lumps, applying Paris green without a carrier, and allowing the aeroplane to fly twice over the same strip so that the plants received a double quantity of the dust. During the flowering season of the rice,

it is particularly dangerous to dust in the early morning, when the flowers are open and usually covered with dew ; the best time is in the evening, when the flowers are closed.

[Maslov (—).] **Маслов (—). Letter to the Editor.** [*In Russian.*]—*Med. Parasitol.* **5** no. 3 p. 467. Moscow, 1936.

In view of a statement that *Culex tritaeniorhynchus*, Giles, was first found in the Russian Union in 1934 [*R.A.E.*, B **24** 229], the author points out that Alektorov published a record of its occurrence in the Russian Far East in 1931, and that he himself has since found it in several places there.

[Vlasenko (N. M.).] **Власенко (Н. М.). Zur Malariologie des Raions Bratsk von Ost-Sibirien.** [On the Malariology of the Bratsk Region in East Siberia.] [*In Russian.*]—*Bull. Inst. sci. Biol. Géogr. Univ. Irkoutsk* **7** no. 1–2, pp. 141–186, 1 graph, 59 refs. Moscow, 1936. (With a Summary in German.)

An account is given of observations on the bionomics of *Anopheles maculipennis*, Mg., race *messeae*, Flni., in the Bratsk district of eastern Siberia, where examination of adults, larvae and eggs showed it to be the only Anopheline present. It bred exclusively in water in and near villages and settlements and did not occur in the vast areas covered with forests or swamps. It rarely attacked man or animals in the open, and did so only in the neighbourhood of shelters in which it rested by day. In villages, it sheltered and fed in the animal quarters, which are damp and cool, and not in the houses, which are dry and well-aired. It fed much more often on domestic animals than on man, but did not apparently prefer them, as men sleeping in sheds with animals or in unheated outhouses were readily attacked. Moreover, in settlements in gold-fields where the workmen lived in unheated barracks and the animals were kept in the open, it occurred in the barracks and fed almost exclusively on man. There was no difference in maxillary index between the individuals that had fed on man and those that had fed on animals.

From the seasonal conditions of the district and observations on the occurrence of the different stages, it is concluded that this Anopheline produces two complete generations during the summer. In 1933, the overwintered adults became active towards the end of May, at a temperature of 6·9–19·3°C. [44·42–66·74°F.], and the adults of the first and second generations appeared in early July and early August. The latter laid eggs between 11th and 20th August, but the larvae failed to develop owing to low temperature in September. The temperatures in this district are high enough to permit the mosquito cycle of *Plasmodium vivax* in June–July, but not in August. Malaria does not occur there, but there is a risk of its introduction owing to the influx of labour from other parts of the Russian Union.

Hackett (L. W.). **Malaria in Europe. An Ecological Study.**—Demy 8vo, xvi + 336 pp., 23 pls., 25 figs. Oxford Univ. Pr. ; London H. Milford, 1937. Price 10*s*. 6*d*.

This book, which is compiled from material collected for lectures given at the London School of Hygiene and Tropical Medicine in

December 1934, consists of a discussion, based almost entirely on European experience, of the newer findings in malaria and the way in which these are changing the ideas of what endemic malaria is, why it persists, and how it can be attacked.

In the introduction, the author deals briefly with malaria in Italy from the distant past until the 19th century, when it appeared sometimes as the cause and sometimes as the effect of some social system or phenomenon, since this has led some to believe that malaria, at least in temperate climates, is a social disease that will disappear if certain social factors are modified, whereas others see it only as a form of parasitism, adapting itself to all sorts of conditions, favoured by certain social factors, but not dependent on them, and only ultimately controllable by reduction of its insect vectors.

In the first chapter, he discusses the recrudescence of malaria during and after the Great War, previous recrudescences that had occurred in the history of Greece and Italy, and the existence of permanent foci in which the disease survives during periods unfavourable to its spread. The observed lack of correlation between malaria and swamps and between its intensity and the numbers of Anophelines led to a reluctance to spend money on measures against larvae that might not be effective. An experiment in Sardinia in which its incidence was reduced by the application of Paris green against the larvae of *Anopheles maculipennis*, Mg., demonstrated the value of larvicides, but also showed that it might be necessary to extend the area under control round the centre to be protected from the half mile recommended in the tropics or the mile used in the United States to as much as 2–3 miles, owing to the greater range of flight of the European vectors. A more important discovery was that, whereas *A. quadrimaculatus*, Say, the chief vector in the United States, breeds in pools, *A. maculipennis* breeds in flowing water. The Malaria Commission of the League of Nations in 1927 recommended the control of the parasite in man by treatment with quinine and the destruction of mosquitos in houses, and advocated a continued study of all aspects of the disease.

In the second chapter are reviewed theories put forward to account for the spontaneous disappearance of malaria in various parts of Europe, the reasons why they proved untenable, and the first discoveries of different races of mosquitos grouped under the name *A. maculipennis* and of means for distinguishing them.

The third chapter deals with studies on cross-breeding, feeding habits and susceptibility to infection of these races, and their subsequent division into two groups, which consist of those races that habitually attack man even when animals are present and are consequently always associated with the transmission of malaria, and those that normally attack animals but may under certain circumstances be forced to feed on man and so may become vectors. As the first group breeds largely in brackish waters, malaria tends to be distributed along coastlines. Stabular deviation is only effective against the second group, which prefers to feed on cattle if these are present. The amount of malaria transmitted is influenced by the numbers of Anophelines, the attraction exerted on them by domestic animals and the presence of infective persons, all of which factors act quantitatively and independently. Other factors affecting transmission are discussed; they include partial hibernation and the production of malarious

houses, healthy carriers of gametocytes, the effect of microclimate on the different races, and races among species of Anophelines in other parts of the world.

In the fourth chapter, the author returns to the question of the two groups and points out that the natural regression of malaria in Europe is probably related to improved methods of agriculture with the consequent increase in the numbers of domestic animals, and is, therefore, taking place chiefly in those areas where members of the second group are prevalent, since these alone prefer animal blood. In certain other places, dangerous races are being gradually replaced by less dangerous ones owing to modification of the characters of their breeding places. As these two groups comprise the races that breed only in fresh water and those that can also breed in brackish water, he considers the question of the different types of breeding places, the selection exercised by the gravid female, the influence of salinity, and the possible part played by larval competition and by progressive changes in the characters of the breeding places in determining seasonal prevalence. He concludes that malaria is an entomological rather than a social problem, existing where certain Anophelines with peculiar feeding habits can maintain themselves in sufficient numbers to ensure transmission, and that the distribution of the dangerous vectors is not haphazard, but is correlated with certain combinations of chemical, physical and biological characters of surface waters.

In the next chapters, he deals with the malaria parasite, immunity in man, treatment in theory and practice, the peculiarities of the disease in temperate climates, the means of appraising a malaria situation, and the organisation necessary for carrying out control measures.

In the final chapter, he outlines the main measures that can be taken to reduce the incidence of malaria under the following headings : suppression of gametocytes in human carriers, protection of man from mosquitos, destruction of larvae, permanent elimination of breeding places, and natural measures of control, including alteration of salinity of breeding places and introduction of larvicidal fish. He concludes that there is no justification for inactivity in the face of any malaria problem, and that though there may be unsolved, and at present insoluble, malaria problems in the world, the important fact is that there are communities that have been oppressed for ages by the disease and could be liberated if a little thought, money and energy were expended on them.

Mosquito Control Engineering I–VIII.—*Engng News Rec.* **117** nos. 4, 6–12, pp. 118–122, 199–201, 225–228, 266–269, 304–307, 341–343, 372–376, 404–406, 42 figs. New York, 1936.

This series of articles on the control of mosquitos in the United States was written with a view to placing before engineers and public works administrators information, not always readily available to them, on the economic importance of eradicating mosquitos and on the part played by engineering in promoting and controlling their breeding places. They comprise : The Growth and Importance of Anti-mosquito Work, by L. O. Howard ; Mosquitoes : Species and Habits, by T. J. Headlee ; Control Technique and Organization, by R. W. Gies ; Inland Control Methods, by J. L. Clarke ; The Salt

Marsh Problem, by R. J. van Derwerker; Effective Malaria Control, by L. L. Williams; Ending Malaria in New Mexico, by C. M. Adams; Mosquito Abatement in Delaware, by W. S. Corkran; Malaria and the Mississippi Valley, by J. A. LePrince; and California's Campaign, by H. F. Gray.

WATSON (R. B.). **Some preliminary Observations on Airplane Dusting for *Anopheles* Larvae Control.**—*Sth. med. J.* **29** no. 8 pp. 862–867, 5 figs. Nashville, Tenn., August 1936. (Abstr. in *Trop. Dis. Bull.* **34** no. 1 p. 71. London, January 1937.)

The lake formed by the closing of one of the dams in the Tennessee Valley will have a shore line of 950 miles and much of it will be less than 3 ft. deep. As *Anopheles quadrimaculatus*, Say, may breed there in abundance, tests were carried out with aeroplane dusting under conditions similar to those expected to arise. The dust used was 11–12·5 per cent. Paris green in powdered soapstone. When 20 particles of Paris Green per square inch was taken as the minimum effective concentration and the aeroplane was flying at a height of 50 feet, the effective width of the dust path was 520 feet. The reduction in larvae varied between 13·7 and 62 per cent., and these results were not considered commensurate with the risks involved in flying low over a tortuous shoreline. Over a small spring-fed lake and swamp the results were far more satisfactory; under poor conditions, with a wind velocity of 10 miles an hour, a reduction of 94 per cent. was obtained in the open lake, 98 per cent. in swampy land covered with dense vegetation and 79 per cent. in a densely wooded area. The cost, using a dust containing 10 per cent. Paris green by volume, was a little over half the cost of dusting by hand from a boat or of oiling.

WOOD (F. D.). ***Trypanosoma neotomae*, sp. nov., in the Dusky-footed Wood Rat and the Wood Rat Flea.**—*Univ. Calif. Publ. Zool.* **41** no. 11 pp. 133–142, 1 pl., 7 refs. Berkeley, Calif., 29th September 1936.

In the course of examining blood from large numbers of dusky-footed wood rats, *Neotoma fuscipes annectens* and *N. f. macrotis*, in California to determine whether they were infected with *Trypanosoma cruzi* [*cf. R.A.E.*, B **23** 41], a new species of trypanosome, here described as *T. neotomae*, was found in 12 out of 62 of the former subspecies and 1 out of 78 of the latter. Approximately 200 fleas from *N. f. annectens* and 10 from *N. f. macrotis* were examined for trypanosomes. The fleas from the latter were *Ceratophyllus* (*Orchopeas*) *caedens*, Jord., and none showed flagellates in the digestive tract, but those from the former were *C.* (*O.*) *wickhami*, Baker, and, in every collection from infected hosts, some or all harboured trypanosomes. One uninfected example of *N. f. annectens* harboured a flea containing trypanosomes. Similar trypanosomes were also seen in lice (*Neohaematopinus inornatus*, Kell. & Ferr.) from wood rats infected with *T. neotomae*. The development of *T. neotomae* in *C. wickhami* is similar to that of *T. lewisi* in *C. fasciatus*, Bosc.

del Ponte (E.) & Riesel (M. A.). **Notas sobre Siphonaptera argentinos. I.** ***Pulex irritans*** **L. en animales salvajes.** [Notes on Argentine Siphonaptera. I. *P. irritans* on wild Animals.]—*Rev. Inst. bact.* **7** no. 4 pp. 696–704, 18 figs., 17 refs. Buenos Aires, July 1936. [Recd. February 1937.]

Records of wild hosts of *Pulex irritans*, L., are cited from the literature. In Argentina it has been found on various hares, foxes and deer.

Dios (R. L.), de Sommerville (E. T. W.), Bonacci (H.) & Aldao (J. A. F.). **Indices de infestación del** *Triatoma infestans* **en la R. Argentina.** [Infection Indices of *T. infestans* in the Argentine Republic.]—*Rev. Inst. bact.* **8** no. 1 pp. 13–141, 4 fldg. graphs., 13 maps, 7 pp. refs. Buenos Aires, November 1936. [Recd. February 1937.]

The authors record and discuss the prevalence of infection with *Trypanosoma cruzi* in *Triatoma infestans*, Klug, on the basis of data obtained by examination of batches of this bug received from 372 localities in most of the provinces and territories of Argentina during 1925–35. They compile infection indices in order to indicate where it is most intensely infected, and so to facilitate the search for human carriers of the trypanosome, as the latter are difficult to recognise, owing to the absence, in most cases, of characters that permit diagnosis. Tables show the numbers of nymphs and adults of each sex examined from each locality and the percentages of infection in them. Infected bugs were obtained from 74·1 per cent. of the localities. In all, 9,686 females, 9,268 males and 11,911 nymphs were examined. Of the total number, 5,122 or 16·5 per cent. harboured trypanosomes, flagellates or both, trypanosomes being found in 7·7 per cent.

Fricks (L. D.). **Review of Plague in Seattle (1907) and subsequent Rat and Flea Surveys.**—*Publ. Hlth Bull.* no. 232, 28 pp. Washington, D.C., November 1936.

An outbreak of plague occurred in man in Seattle, Washington, in 1907, and infected rats were found from that time up to 1917, the largest number being taken in 1913–14. Two intensive rat-flea surveys have been carried out, one during 1927–29 and the other during 1930–32. The incidence of fleas on rats was low, the index for *Xenopsylla cheopis*, Roths., in the last survey being only a little over 0·4.

[Mamontov (I. M.) & Kolpakova (S. A.).] **Мамонтов (И. М.) и Колпакова (С. А.). Zur Frage über die Wirkung des Zyankalziums auf die Fauna der Höhlen des kleinen Ziesels** (*Citellus pygmaeus* **Pall.).** [On the Question of the Effect of Calcium Cyanide on the Fauna of the Burrows of the Small Ground Squirrel, *C. pygmaeus*.] [*In Russian.*]—*Rev. Microbiol.* **15** no. 2 pp. 243–248, 1 fig. Saratov, 1936. (With a Summary in German.)

In the course of tests in the Saratov district in July 1935 of an apparatus, which is briefly described, for blowing measured quantities of calcium cyanide dust into the burrows of ground squirrels (*Citellus pygmaeus*), the action of the fumigant on Arthropods in them was

studied. Only inhabited burrows were treated, the fumigant was applied at the rate of 1·8 or 5·4 gm. per burrow, and after the treatment the entrance hole was plugged with cotton-wool to prevent fresh insects from entering. The burrows were opened after 24, 48 or 72 hours. All the ground squirrels were killed, and their bodies were always lying at the furthest end of the first vertical passage. Fleas in this part of the burrow were also dead, but Gamasid mites and most of the lice on the ground squirrels survived, even when 5·4 gm. calcium cyanide was used and the exposure was 72 hours. Moreover, none of the fleas or other Arthropods occurring in the side turnings or in the nests was affected.

[FEDOROV (V. N.), KAĬZER (G. A.) & FLEGONTOVA (A. A.).] **Федоров (В. Н.), Кайзер (Г. А.) и Флегонтова (А. А.). Die am linken Ufer des Ural gelegenen Sande Bijriouk und deren epizootologische Charakteristik.** [The Biĭryuk Sands situated on the left Bank of the Ural and their epizootic Characteristics.] [*In Russian.*]—*Rev. Microbiol.* **15** no. 2 pp. 254–270, 4 graphs, 11 refs. Saratov, 1936. (With a Summary in German.)

An account is given of investigations on wild mammals, chiefly rodents, carried out in the spring and summer of 1935 among ridges of sands occurring in an area of nearly 200 sq. miles in western Kazakstan and situated some 75 miles east of the river Ural. Epidemics of plague and epizootics among rodents frequently occur to the west and north-west of this region, but none has been recorded from the steppes to the east. The sands thus appear to form a natural barrier 10–12 miles wide preventing the spread of the disease eastwards, though epizootics among ground squirrels (*Citellus*) and mice have been observed in them. The topography of the area is described, and lists are given of 25 species of mammals that occur there, including 17 species of rodents, and of the fleas and ticks taken on some of them. The sands form rows of ridges separated by inhabited steppe. They are only sparsely populated by rodents, and the periods of the year in which the different species become most abundant do not coincide. This prevents the establishment of plague and its spread through the sands to the steppes in the east, where ground squirrels are comparatively abundant.

[ZASUKHIN (D. N.) & TIFLOV (V. E.).] **Засухин (Д. Н.) и Тифлов (В. Е.). Ectoparasites of the Rodents :** *Mus musculus*, *Lagurus lagurus* **and** *Microtus arvalis*. **Communication IV.** [*In Russian.*] —*Rev. Microbiol.* **15** no. 2 pp. 271–274, 32 refs. Saratov, 1936.

This paper belongs to a series on ectoparasites of rodents associated with disease in the Russian Union [*cf. R.A.E.*, B **23** 178] and contains lists of the fleas, ticks and mites taken on *Lagurus lagurus*, the domestic mouse (*Mus musculus*), and *Microtus arvalis*, with references to the literature concerned.

BLANC (G.) & BALTAZARD (M.). **L'influence du jeûne sur la persistance du virus du typhus murin chez la puce** *Xenopsylla cheopis*.—*C. R. Acad. Sci. Fr.* **204** no. 11 pp. 919–920, 2 refs. Paris, 1937.

A large batch of newly emerged fleas (*Xenopsylla cheopis*, Roths.) was kept for 15 days with rats infected with murine typhus and was

then starved for 12 days, at the end of which time only 4 fleas survived. At intervals from the 12th day of feeding until the last day of starvation (when the 4 survivors were used) suspensions made of some of the fleas were injected into guineapigs, which became infected.

BRUMPT (E.). **Transmission expérimentale exceptionelle de la fièvre récurrente du Maroc à** *Spirochaeta hispanica* **par la tique cosmopolite** *Rhipicephalus sanguineus.—Ann. Parasit. hum. comp.* **14** no. 6 pp. 564–570, 22 refs. Paris, 1st November 1936.

The results of attempts to transmit *Spirochaeta hispanica* by means of the tick, *Rhipicephalus sanguineus*, Latr., have been sometimes positive [*R.A.E.*, B **21** 245; **24** 46] and sometimes negative [**23** 261; **25** 25]. The experiments here described were undertaken in 1935 and 1936, with a view to obtaining further information on the importance of this tick in the epidemiology of relapsing fever caused by this spirochaete.

Of 11 guineapigs bitten by adults or nymphs or inoculated with suspensions of engorged adults or nymphs, all infected in the larval stage, only two became infected, one that had been bitten by more than 800 nymphs and one that had been inoculated with part of a suspension of 110 engorged nymphs. A dog bitten by more than 200 adults died on the 6th day without becoming infected, and negative results were obtained when two guineapigs were inoculated with its blood. The spirochaetes seemed to be rare in these ticks, but must have invaded the salivary glands, since the disease was transmitted by biting.

BRUMPT (E.). **L'ixodiné** *Rhipicephalus sanguineus* **ne transmet pas expérimentalement la fièvre récurrente de l'Asie centrale à** *Spirochaeta persica.—Ann. Parasit. hum. comp.* **14** no. 6 pp. 571–573, 2 refs. Paris, 1st November 1936.

These experiments were made with large numbers of nymphs and adults of *Rhipicephalus sanguineus*, Latr., that had fed in the larval stage on a guineapig infected with a strain of *Spirochaeta persica* from Russian Turkestan. Guineapigs were bitten by nymphs or were inoculated (subcutaneously or intraperitoneally) with suspensions of engorged nymphs or fasting adults, but none became infected.

BRUMPT (E.) & CAMINOPETROS (J.). **Non transmission de la fièvre récurrente grecque à** *Spirochaeta hispanica* **var.** *peloponesica*, **par la tique** *Rhipicephalus sanguineus.—Ann. Parasit. hum. comp.* **14** no. 6 pp. 574–577, 4 refs. Paris, 1st November 1936.

Experiments on the transmission of *Spirochaeta hispanica* var. *peloponesica* were undertaken in Paris with a strain of *Rhipicephalus sanguineus*, Latr., that originally came from Morocco, and in Athens with a local strain. Guineapigs were inoculated with suspensions of adults taken on dogs living near infected persons [*cf. R.A.E.*, B **25** 25], of adults that had fed 14 days previously on an infected guineapig, of adults 15 days old derived from infected larvae, and of engorged and unengorged nymphs from infected larvae. All results were negative, as were those in which nymphs from infected larvae were allowed to engorge on healthy guineapigs.

Brumpt (E.). **Le spirochète (*Spirochaeta recurrentis*) de la fièvre récurrente à poux de Chine n'est pas transmis expérimentalement par la piqûre de l'*Ornithodorus moubata* et ne se conserve pas chez cet acarien.**—*Ann. Parasit. hum. comp.* **14** no. 6 pp. 578–585, 21 refs. Paris, 1st November 1936.

After reviewing the attempts that have been made in the past to transmit louse-borne relapsing fever (due to *Spirochaeta recurrentis*) by various species of ticks, the author describes experiments carried out with two strains of the spirochaete from Shanghai and two from Peiping, using the tick, *Ornithodorus moubata*, Murr. More than 300 nymphs were allowed to bite a monkey 29 days after they had fed on a mouse infected with a strain from Shanghai, and on the same day the monkey was inoculated with a suspension of about 200 of the same nymphs. Nymphs that had fed on mice infected with one or other of the two Shanghai strains were fed on or inoculated into other mice about 5 and 7 months later. Nymphs fed on two squirrels each infected with one of the Pekin strains were allowed to engorge about 2 months later on 2 guineapigs. Suspensions of them were then inoculated subcutaneously or intraperitoneally into mice. In all cases the results were negative.

Brumpt (E.). **Etude expérimentale du *Plasmodium gallinaceum* parasite de la poule domestique. Transmission de ce germe par *Stegomyia fasciata* et *Stegomyia albopicta*.**—*Ann. Parasit. hum. comp.* **14** no. 6 pp. 597–620, 10 figs., 12 refs. Paris, 1st November 1936.

A short account of the work on the transmission of *Plasmodium gallinaceum* that is described in detail in the present paper has already been noticed [*R.A.E.*, B **24** 297]. Particulars of the experiments are shown in tables. The parasite was successfully transmitted to fowls by *Aëdes* (*Stegomyia*) *albopictus*, Skuse, which showed a high rate of infection, but not by an autogenous race of *Culex pipiens*, L., nor by an unidentified species of *Culex* obtained from Richelieu (Indre-et-Loire). Turkeys were infected by inoculation, but showed only a few parasites.

Brumpt (E.). **Longue conservation de 28 mois du virus du typhus de São Paulo chez l'argasiné *Ornithodorus turicata*. Non transmission par la piqûre de cet acarien.**—*Ann. Parasit. hum. comp.* **14** no. 6 pp. 621–628, 6 refs. Paris, 1st November 1936. **Le virus de la fièvre pourprée des Montagnes Rocheuses peut se conserver plus de 600 jours dans le corps de l'*Ornithodorus turicata*, mais n'est pas transmis par la piqûre de cet acarien.**—*T.c.* pp. 629–631, 2 refs.

In these two papers are given the details of a number of experiments to determine whether *Ornithodorus turicata*, Dug., can act as a host for the viruses of São Paulo typhus and Rocky Mountain spotted fever. In no case was the infection transmitted to guineapigs by biting, but inoculations of suspensions of ticks at intervals showed that the viruses were still present in them 851 and 620 days, respectively, after the infecting feed.

Brumpt (E.). **Evolution expérimentale de l'*Ornithodorus lahorensis*. Similitude biologique des stades post-embryonnaires de cet argasiné et de ceux de l'*O. megnini*. Rôle pathogène éventuel.**—*Ann. Parasit. hum. comp.* **14** no. 6 pp. 632–639, 3 figs., 26 refs. Paris, 1st November 1936.

Although *Ornithodorus lahorensis*, Neum., is abundant on certain domestic animals in Central Asia and causes losses to stock breeders, little work has been done on its bionomics. The author succeeded in rearing it on sheep, but not on dogs or guineapigs. The larval stage, two nymphal instars and part of the third are spent on the same host. The engorged third-instar nymphs drop to the ground and moult, giving rise to adults. After feeding and pairing, each female lays between 200 and 560 eggs. The life-cycle from egg to egg lasts about 108 days. In central Asia, it is apparently the third-instar nymphs that overwinter on animals. The tick has been recorded from the Punjab, Persia, Russian Turkestan, Transcaucasia, Tibet, Palestine and certain parts of Asia Minor. It parasitises man, sheep, camels and various other mammals, and must have been disseminated by caravans over an area far wider than it occupies at present, but did not become established where conditions were unfavourable. Experiments on its possible relation to various diseases are briefly discussed from the literature.

Brumpt (E.). **Contribution à l'étude de l'évolution des ornithodores. Biologie et longévité de l'*Ornithodorus megnini*.**—*Ann. Parasit. hum. comp.* **14** no. 6 pp. 647–651, 1 fig., 15 refs. Paris, 1st November 1936.

Ornithodorus megnini, Dug., develops in the ears of horses and cattle and through irritation prevents the normal development of the animals and sometimes causes death. It is indigenous to America, but was imported some time ago into South Africa and has recently been recorded from India [see next paper]. It has been reared on dogs and cats in the laboratory from nymphs collected in Mexico in 1932. The larvae engorge rapidly on lymph, and, more rarely, on blood, and moult in about 6 days. Two types of nymphs were collected from the ears of a cat, so that there would appear to be three moults (not two as has been suggested by other workers), of which only the last, which gives rise to adults, takes place off the host. The fertilised females oviposit irregularly over a period of several weeks or months without taking a blood meal and then die. One laid 600 eggs, but according to other workers they may lay as many as 1,500. Unfertilised females are reported to live for one or even two years, but the author possesses three that are still living 3 years and 8 months after emergence ; they have been maintained at laboratory temperatures (12–25°C. [53·6–77°F.]). The life-cycle from egg to egg may be completed in 74 days, but usually takes longer and may last more than 250 days.

Kingston (J. S.). **Spinose Ear Tick in India.**—*J. R. Army vet. Cps* **7** pp. 142–143. Aldershot, 1936. (Abstr. in *Vet. Bull.* **6** no. 11 p. 812. Weybridge, November 1936.)

The author describes a case of cerebral derangement in an Australian horse in India. *Post-mortem* examination revealed the presence of 10 mature ticks in the internal acoustic meatus of both

ears. Their presence had resulted in perforation of the tympanum and necrosis of the auricular nerves adjacent to the semicircular canals of the left petrous temporal bone. The ticks were identified as *Ornithodorus megnini*, Dug. This is believed to be the first record of the occurrence of this species in Asia.

DONATIEN (A.) & LESTOQUARD (F.). **Existence en Algérie d'une** *Rickettsia* **du chien.**—*Bull. Soc. Path. exot.* **28** pp. 418–419. Paris, 1935. **Recherches sur** *Rickettsia canis.* **Comparaison avec** *Rickettsia conori.*—*Op. cit.* **29** no. 10 pp. 1052–1056. 1936.

In the first paper, the authors describe *Rickettsia canis*, sp. n., causing a disease in Algeria in dogs infested with the tick, *Rhipicephalus sanguineus*, Latr. Four out of five dogs died.

In the second paper, they state that cases have been observed in which dogs became infected with the disease as soon as they became heavily infested with this tick, and it is difficult to believe that it is not the vector. Moreover, the disease begins to appear at the season when the ticks become active. Monkeys (*Macacus*) inoculated with suspensions of adult ticks from sick dogs, or of unengorged larvae derived from such ticks, became infected, and *Rickettsia canis* was observed in them. *Rickettsia conori*, the causal agent of Marseilles fever [*R.A.E.*, B **20** 243], is also transmitted by *Rhipicephalus sanguineus*, but from a comparison of the behaviour in laboratory animals of a strain of this rickettsia from Morocco with that of *Rickettsia canis* and from cross-immunity tests, the authors conclude that the two are specifically distinct. *Rickettsia canis* has also been recovered from dogs at Marseilles and Montpellier in the south of France.

DONATIEN (A.) & LESTOQUARD (F.). *Rickettsia bovis*, **nouvelle espèce pathogène pour le boeuf.**—*Bull. Soc. Path. exot.* **29** no. 10 pp. 1057–1061, 2 refs. Paris, 1936.

The authors describe and discuss a new species of rickettsia, *Rickettsia bovis*, found in the blood of cattle bitten by an undetermined species of tick of the genus *Hyalomma* received from Persia, and in the blood of cattle subinoculated from them. The disease it causes is not severe.

GASCHEN (H.). **Contribution à l'étude de l'infection naturelle des anophèles au Tonkin.**—*Bull. Soc. Path. exot.* **29** no. 10 pp. 1093–1095, 4 refs. Paris, 1936.

The part played by *Anopheles hyrcanus* var. *sinensis*, Wied., in the transmission of malaria in the Red River Delta, Tonkin, has been confirmed by dissections made of Anophelines collected in the course of an epidemic that occurred in a locality about 9 miles from the one in which it was recently found infected [*R.A.E.*, B **25** 86]. Of 661 females of *A. hyrcanus* var. *sinensis*, 28 were infected, of which 16 showed sporozoites. Sporozoites were also found in one out of 68 females of *A. hyrcanus* var. *nigerrimus*, Giles, and one out of 51 females of *A. tessellatus*, Theo.; the scarcity of these two Anophelines may be the only factor that prevents their being important vectors of the disease.

ROUBAUD (E.), COLAS-BELCOUR (J.), TOUMANOFF (C.) & TREILLARD (M.). **Recherches sur la transmission de** *Dirofilaria immitis* **Leidy.**—*Bull. Soc. Path. exot.* **29** no. 10 pp. 1111–1120, 1 pl., 17 refs. Paris, 1936.

Experiments are described in which certain races of *Anopheles maculipennis*, Mg., a strain of *Aëdes aegypti*, L., from Cuba and one of *A. albopictus*, Skuse, from Indo-China were allowed to feed on a dog heavily infected with *Filaria* (*Dirofilaria*) *immitis*. A high proportion of the mosquitos died rapidly of their infection, and the series of experiments was interrupted by the death of the dog. Development of the parasite was observed in the Anophelines : microfilariae that had reached the sausage stage were seen in one of the females that lived 9 days, and in the only female that lived longer mature larvae were observed on the 17th day. No development took place in either species of *Aëdes*. In the case of *A. aegypti* infection of the malpighian tubes had occurred in most of the specimens, but the microfilariae remained in a mass without undergoing any development. Since this is contrary to the findings of other workers [*cf. R.A.E.*, B **20** 9 ; **25** 71 ; etc.], it is suggested that there are racial differences either in *A. aegypti*, or, more probably, in the filaria in different parts of the world, and that the different geographical races of the filaria are adapted to those mosquitos that are in closest contact with the local dogs.

JACK (R. W.). **Water and Fat Contents of Tsetse Flies.**—*Nature* **139** no. 3505 p. 31. London, 2nd January 1937.

Recent studies on the physiological response of tsetse flies (*Glossina*) to environmental conditions have been largely concerned with the water and fat contents of the flies. The water content usually seems to be estimated from the gross wet and gross dry weights of the flies. It is pointed out, however, that the ether-soluble " fat " contains no water and is a very variable quantity in different circumstances. Thus, with the same quantity of water, the water content, expressed as a percentage of the wet weight, will vary inversely with the fat content. Unfed flies that have been starved for any considerable period have naturally consumed a large portion of their fat reserve, and the loss of fat tends to raise the final water percentage if this is calculated from gross dry and wet weights. In such a case it may appear that no significant disturbance of the water balance has taken place during an experiment, whereas if the weight of the " fat " is subtracted from both dry and wet weights before the percentage of water is calculated, a significant difference may be revealed. It is also pointed out that in the case of an insect containing a high percentage of its weight in water, a considerable loss of actual water is not very conspicuously reflected in the final ratio between wet and dry weights.

ZUMPT (F.). **Untersuchungen über Tsetsefliegen und deren Bekämpfung im Pflanzungsgebiet des Kamerunberges.** [Investigations on Tsetse Flies and their Control in the Plantation Districts of the Cameroon Mountain.]—*Tropenpflanzer* **40** nos. 1–2 pp. 1–31, 65–76, 13 figs., 5 diagr., 25 refs. Berlin, January–February 1937.

An account is given of observations on tsetse flies made by the author during a three months' tour at the end of 1935 in the plantation

district of the Cameroon Mountain. In some localities in this area, 20 and even 40 per cent. of the natives had been found to be infected with sleeping sickness early in 1935, and trypanosomiasis of domestic animals is widespread. The district lies in the equatorial rain forest zone, and the annual rainfall is very heavy, averaging 390 ins. in some places. The temperature ranges from 21 to 32°C. [69·8–89·6°F.], and the average air humidity is 80 per cent., though it can be greatly reduced temporarily by the wind known as the Guinea harmattan. There is a slight dry season on the western slope of the Mountain and a well marked one on the eastern slope.

The high air humidity prevents a definite massing of the tsetse flies in circumscribed foci, and this affects the application of control measures. Suitable breeding places occur at a distance from water both in the virgin forest and in the plantations, the humidity being high even in the dry season, and opportunities for breeding are likely to increase in the plantations, owing to the recently introduced practice of allowing felled trees to lie on the ground and growing banana plants between them, so that the soil is loose and shaded. The species found were, in order of decreasing abundance, *Glossina palpalis palpalis*, R.-D., *G. pallicera*, Big., *G. haningtoni*, Newst. & Evans, *G. caliginea*, Aust., *G. nigrofusca*, Newst., and *G. tabaniformis*, Westw.

G. haningtoni was the commonest species of the subgenus *Austenina*, only 3 individuals of *G. nigrofusca* and 1 of *G. tabaniformis* being taken. These three species are active at twilight and sometimes during the night, and might, therefore, infect cattle moved by night. Their nocturnal habits may explain their apparent scarcity. Man appears to be the chief source of food for *G. palpalis* in this district ; the few domestic animals, especially pigs, are also attacked, but wild hosts are rare. This conclusion is supported by the fact that females were nearly as numerous as males and even predominated in one locality, for where wild hosts abound males appear to predominate. It also explains both the low density of *G. palpalis* and the high percentage of infection with sleeping sickness [*cf. R.A.E.*, B **19** 13]. *G. pallicera*, though coming next in abundance to *G. palpalis*, occurs in dense forest and is therefore of less importance. Males predominated in the catches, so that man is not its chief host.

As regards control, clearing is feasible only in connection with river crossings and landing places, but, in view of the particular conditions of the area, the author considers that the numbers of flies could be significantly reduced by fly-boys and traps. Various types of traps are described [*cf.* **21** 113, etc.].

YUILL (J. S.) & CRAIG (R.). **The Nutrition of Flesh Fly Larvae,** *Lucilia sericata* **(Meig.). ii. The Development of Fat.**—*J. exp. Zool.* **75** no. 1 pp. 169–178, 4 graphs, 12 refs. Philadelphia, Pa, 5th January 1937.

The following is substantially the authors' summary. Larvae of *Lucilia sericata*, Mg., were reared on fish heads as a normal diet and on the sterile synthetic diet developed by others [*R.A.E.*, B **21** 88]. With both diets the total ether-extractable material, or fat, increases from 6 per cent. in young larvae to 30 per cent. in the full-grown larvae and decreases to 20 per cent. in the pupae. The saponification number of the fat is 190, rising to 215 near the end of larval life, on normal diet, and 220 throughout larval life on the synthetic diet. The iodine

number is 140, falling to 120 near the end of larval life, on normal diet, and 60 throughout larval life on the synthetic diet. The saponification numbers of fish fat and of the fat in the synthetic diet are 210 and 195, and the iodine numbers 113 and 30, respectively. It is concluded that not only the type of larval fat but also the changes in its composition during growth are markedly influenced by the type of fat ingested.

SCHWARDT (H. H.). **Variations of seasonal Cycle in the Genus** *Tabanus*.—*Ann. ent. Soc. Amer.* **29** no. 4 pp. 589–592, 4 refs. Columbus, Ohio, December 1936.

The following is taken from the author's summary: Life-history records in Arkansas show that *Tabanus lineola*, F., and *T. atratus*, F., can develop from egg to adult during one summer, though the latter usually takes a year and may take more. *T. sulcifrons*, Macq., *T. costalis*, Wied., *T. lasiophthalmus*, Macq., *T. benedictus*, Whitney, and *T. trimaculatus*, P. de B., all require approximately a year. *T. stygius*, Say, usually takes two years, although certain individuals reach maturity in one year.

DAVIS (G. E.). *Ornithodorus turicata*: **the possible Vector of Relapsing Fever in southwestern Kansas. Preliminary Report.**—*Publ. Hlth Rep.* **51** no. 50 p. 1719, 1 ref. Washington, D.C., 11th December 1936.

Cases of relapsing fever have been reported from several localities in Kansas since 1931. In the course of investigations on possible vectors, carried out in August and September 1936, about 2,000 examples of *Ornithodorus turicata*, Dug., which was not previously known to occur in Kansas, were collected, different stages being found on various hosts, in rodent burrows, and in holes in the sand. The ticks were allowed to engorge on rats, and spirochaetes were thus recovered from three batches, collected from the burrows of a prairie dog [*Cynomys*] and a rabbit and from a hole in the sand, respectively. The burrow of the prairie dog was on a ranch on which a case of relapsing fever had occurred.

PHILIP (C. B.). **Six Years' intensive Observation on the seasonal Prevalence of a Tick Population in western Montana. A preliminary Report.**—*Publ. Hlth Rep.* **52** no. 1 pp. 16–22, 1 graph, 1 ref. Washington, D.C., 1st January 1937.

This is a summary of the results of quantitative studies on the population of adults of *Dermacentor venustus*, Banks (*andersoni*, Stiles) in a tract of land 40 acres in extent in the Bitterroot Valley, Montana, over a period of 6 years (1930–35). The ticks were collected by sweeping with a piece of flannel tied to the end of a pole like a flag. Sweeping was carried out across the tract along five equidistant straight lines, and it was estimated that about 1 per cent. of the total area was covered. The operation was undertaken over exactly the same straight lines at approximately weekly or biweekly intervals, according to conditions, throughout the "tick season," which lasts from the first open weather and disappearance of snow until late June or early July. Ticks caught were released again immediately. Those taken early in the season were marked with a spot of paint, a different colour for each season, and by this means were found to

persist, unfed, through at least two seasons. The numbers reached their maximum about the middle of April, but decreased rapidly during the hot weather in June, so that few or no ticks were taken in early July. Neither rain nor darkness caused them to leave the vegetation ; moderate concentrations were noted on game trails.

SANDERS (D. A.). **Observations on Canine Babesiasis (Piroplasmosis.)**—*J. Amer. vet. med. Ass.* **90** no. 1 pp. 27–38, 16 refs. Chicago, Ill., January 1937.

In the course of this account of a chronic form of piroplasmosis due to *Piroplasma* (*Babesia*) *canis* in dogs in Florida, the author discusses the ticks that might be concerned in transmission and concludes that as *Rhipicephalus sanguineus*, Latr., is by far the most common species found in kennels and on infected animals, it is probably the most important vector.

CRAM (E. B.). **A Species of Orthoptera serving as intermediate Host of** *Tetrameres americana* **of Poultry in Puerto Rico.**—*Proc. helminth. Soc. Wash.* **4** no. 1 p. 24. Washington, D.C., January 1937.

Experiments in Porto Rico during the winter of 1935–36 showed that an additional species of Acridid [*cf. R.A.E.*, B **19** 183], *Scyllina cyanipes*, F., can serve as an intermediate host of *Tetrameres americana*. The grasshoppers were fed on eggs of this Nematode, and the larvae developed to the third stage in their body tissues. When fowls were fed on these larvae, the latter developed to adults in the proventriculus. Attempts to infect the mole cricket, *Scapteriscus vicinus*, Scud., and the cockroach, *Periplaneta australasiae*, F., were unsuccessful.

MOHLER (J. R.). **Report of the Chief of the Bureau of Animal Industry, 19**[35–]**36.**—60 pp. Washington, D.C., U.S. Dep. Agric., 1936.

Studies on skin lesions in cattle due to *Filaria* (*Stephanofilaria*) *stilesi* were continued with a view to correlating their seasonal incidence with the abundance of certain insects. Various species of flies, lice and other insects were examined for the presence of the intermediate stages of the parasite, but negative results were obtained. In New Mexico, attempts were made to destroy the small larvae of *Oestrus ovis*, L., in the nasal passages of sheep before they migrated to the sinuses. Of the various substances tested, the most effective was a 3 per cent. solution of lysol ; an average of 0·6 larvae per animal was found in 44 sheep treated with this substance as compared with 10 in untreated ones.

In investigations in Porto Rico on the intermediate hosts of parasitic worms infesting poultry [*cf.* preceding paper], woodlice (*Cubaris murina*, Brandt) were experimentally infected with *Dispharynx spiralis*. In the United States, two species of ants, *Tetramorium caespitum*, L., and *Pheidole vinelandica*, For., were found to be intermediate hosts of the poultry tapeworms, *Raillietina echinobothrida* and *R. tetragona*. Fowls were experimentally infected by feeding them on cysticercoids from naturally infected ants. Complete development, with segments of the Cestode passing in the fowl droppings, required about 3 weeks. Dung beetles and grasshoppers acted as intermediate hosts for *Choanotaenia infundibulum*, and grasshoppers for *Raillietina numida*.

The results of an investigation to determine whether vectors other than mosquitos transmit the dog heart worm, *Filaria* (*Dirofilaria*) *immitis*, have been inconclusive. Fleas, sucking lice and ticks from infested dogs were found to contain larvae, but these were either dead or had failed to transform into the infective stage.

KELSER (R. A.). **Transmission of the Virus of Equine Encephalomyelitis by** *Aëdes taeniorhynchus*.—*Science* **85** no. 2198 p. 178, 1 ref. New York, 12th February 1937.

In experiments in 1936, *Aëdes taeniorhynchus*, Wied., transmitted the western type of equine encephalomyelitis from one guineapig to another, but did not transmit the eastern type. In one of a number of positive experiments, a single mosquito feeding only once produced the disease and death of the guineapig in five days.

HAJEK-HALKE (H.). **Noch einmal "Kribbel-Mücken."** [A further Note on Simuliids.]—*Natur u. Volk* **66** no. 12 pp. 632–635, 5 figs. Frankfurt a.M., December 1936. [Recd. March 1937.]

In the course of observations on *Simulium columbaczense*, Schönb., breeding in streams in southern Germany, the author found that adults emerged from pupae on the stems and leaves of aquatic plants even after they had been kept dry for over 8 days.

PAPERS NOTICED BY TITLE ONLY.

PATTON (W. S.). **Studies on the Higher Diptera of Medical and Veterinary Importance. A Revision of the Species of the Genus** *Musca* **based on a comparative Study of the Male Terminalia. III. A practical Guide to the Ethiopian Species** [including two new ones].—*Ann. trop. Med. Parasit.* **30** no. 4 pp. 469–490, 11 figs., 6 refs. Liverpool, 23rd December 1936. [*Cf. R.A.E.*, B **21** 286.]

[RODENDORF (B. B.).]. **Родендорф (Б. Б.). Versuch einer Bestimmungstabelle für Sarcophaginen-Weibchen.** [An Attempt to make a Key for Females of SARCOPHAGINAE.] [*In Russian.*]—*Bull. Soc. Nat. Moscou* Sect. biol. (N. S.) **45** no. 4 pp. 279–284. Moscow, 1936.

SALEM (H. H.). **A Summary of the Egyptian Species of the Genus** *Sarcophaga* **with a Description of** *S. rohdendorfi* **nov. sp. (Diptera-Tachinidae)**.—*Bull. Soc. R. ent. Égypte* **20** pp. 229–247, 3 figs. Cairo, 1936. [Revision of a previous paper : *R.A.E.*, B **24** 41.]

WILSON (G.). **Notes on Mosquitoes of Belfast** [including *Anopheles maculipennis*, Mg. and *A. claviger*, Mg.].—*Irish Nat. J.* **6** no. 7 pp. 166–167. Belfast, January 1937.

RAYNAL (J.). **Sur une nouvelle espèce de phlébotome du nord de la Chine :** *Phlebotomus khawi* **n. sp.**—*Ann Parasit. hum. comp.* **14** no. 6 pp. 529–540, 2 pls., 7 figs., 16 refs. Paris, 1st November 1936.

BRUMPT (E.). **Distribution géographique et rôle en pathologie humaine de l'***Ornithodorus savignyi* [review of the literature].—*Ann. Parasit. hum. comp.* **14** no. 6 pp. 640–646, 28 refs. Paris, 1st November 1936.

DE BEAUREPAIRE ARAGÃO (H.). **Ixodidas brasileiros e de alguns paizes limitrophes.** [Ticks of Brazil and some adjoining Countries.]—*Mem. Inst. Osw. Cruz* **31** no. 4 pp. 759–844, 4 figs., 1 pl., 4 pp. refs. Rio de Janeiro, 1936. (With a Summary in English.)

An account is given of the classification and distribution of the ticks of Brazil (and some that occur in neighbouring countries), and of the bionomics of a number of the species, particularly those that are concerned in the transmission of diseases of man or animals. Of the 45 Brazilian species, 30 belong to the genus *Amblyomma*. All specimens of *Argas persicus*, Oken, from Brazil were found to differ in characters of the peritrema from those obtained from northern Argentina, Texas and the Anglo-Egyptian Sudan; they are considered to represent a new variety, for which the name *dissimilis*, n., is proposed.

In the course of discussing the classification of ticks in general, the author erects the new family NUTTALLIELLIDAE for *Nuttalliella namaqua*, Bedford, which occurs in South Africa [*R.A.E.*, A **19** 184].

OGURA (K.). **The Ticks parasitic on the principal Domestic Animals in Formosa, Japan.**—*Mem. Fac. Sci. Agric. Taihoku* **19** no. 2, Zootechny no. 2 pp. 75–85, 5 pls. Taihoku, Formosa, 1936.

Descriptions are given of the adults of *Boophilus annulatus* var. *caudatus*, Neum., which generally attacks cattle and sometimes water buffalo in Formosa, *Rhipicephalus sanguineus*, Latr., which attacks dogs, cattle and water buffalo, *Amblyomma testudinarium*, Koch, which attacks cattle, water buffalo and pigs, and *Haemaphysalis hystricis*, Sup., *H. flava*, Neum., and *H. formosensis*, Neum., which attack dogs and wild pigs.

RASTÉGAIEFF (E. F.). **Essais de transmission de la spirochétose des poules au moyen des gamasides** "*Dermanyssus gallinae.*"—*Ann. Soc. belge Méd. trop.* **16** no. 4 pp. 513–520, 17 refs. Brussels, 31st December 1936.

In view of the doubt that exists as to the ability of *Dermanyssus gallinae*, DeG., to transmit *Spirochaeta gallinarum* [*cf. R.A.E.*, B **2** 168; **18** 103; **20** 105], the author undertook several experiments at Leningrad during 1932–33. Mites collected on 25th October 1932 and kept under laboratory conditions at a temperature of 15–17°C. [59–62·6°F.] were fed on 25th November on an infected fowl that showed numerous spirochaetes in its blood. The engorged mites were divided into two lots, one of which was placed on the same day on a healthy fowl and the other kept in the laboratory at 15–17°C. This fowl never showed spirochaetes in its blood, but it also could not be infected by means of *Argas persicus*, Oken, so that the result was inconclusive. On 1st December, the second lot of mites was placed on a healthy fowl. No spirochaetes were seen in its blood up to 1st February 1933; this result was not due to immunity, since it subsequently contracted the disease from infected examples of *A. persicus*. It had been kept in a basket at 18–22°C. [64·4–71·6°F.], and mites were present in the basket. From 9th to 11th February, a healthy fowl was kept in this basket, and although mites were still

present, it showed no spirochaetes. The basket was then left in the incubator for 17 days, and the mites, which were known to be present, were left unfed. A healthy bird was placed in the basket on 28th February and remained there until 9th March, but did not become infected. Mites reared from eggs laid on 2nd September 1933 were kept under laboratory conditions at 15–17°C. and fed on a healthy fowl. Infected examples of *A. persicus* that had been kept at a temperature of 15–17°C. were allowed to engorge on 11th and 12th September on a second fowl and were then removed. This bird showed spirochaetes in its blood on 17th and was, on the same day, placed in the basket containing the bird with the mites. Although the spirochaetes continued to be numerous on the 19th and 20th and although the body of the second bird, which died on 21st, was left for a further day in the basket, the first bird showed no spirochaetes up to the time of its death on 13th October. Another fowl was then kept in the basket until 29th October but remained uninfected ; it was subsequently proved to be susceptible.

Thus all the experiments gave negative results, but it was shown in the course of them that *A. persicus* can transmit *S. gallinarum* even when it has been kept at temperatures below 22°C., and remains infective for several years [*cf.* **14** 170], provided that it is fed each year.

LEVER (R. A.). **Report of Entomologist for Year 1935–36.**—4 pp. [Tulagi,] Brit. Solomon Is. Prot. agric. Comm., 1936.

A total of 2,000 individuals of *Spalangia sundaica*, Graham, brought to the Solomon Islands from the Northern Territory, Australia, have been liberated against *Lyperosia exigua*, de Meij. [*cf. R.A.E.*, B **23** 169]. The pads of cow-dung containing pupae of *L. exigua* that were collected to provide host material for the parasites were infested with swarms of the predacious ant, *Pheidole oceanica*, Mayr, and it was necessary to place them on small tables, spray them to destroy the ants, and smear the legs of the tables with adhesive to prevent further infestation. The parasites, which were fed on saturated sugar solution, paired and oviposited in the fly pupae.

Entomological Investigations.—*Rep. Coun. sci. industr. Res. Aust.* **10** (1935–36) pp. 22–29. Canberra, 1936.

The work carried out in Australia by the Division of Economic Entomology during 1935–36 is reviewed ; certain of the investigations in connection with the control of sheep blowflies have already been noticed [*cf. R.A.E.*, B **24** 133, 134 ; **25** 11]. Identification of maggots from more than 1,000 cases of sheep attacked by blowflies in different parts of Australia showed that *Lucilia cuprina*, Wied., was present in 80 per cent. of the strikes and species of *Calliphora* in almost all the others ; *L. sericata*, Mg., was rare as a primary cause of strike. Low night temperatures considerably increase the time required for maturation of the eggs of *L. cuprina* and reduce the number laid. This species is particularly well adapted to live in arid country ; when the rate of desiccation was increased by passing a current of dried air over infested carrion, the growth of the maggots was retarded and under-sized pupae were produced, but survival was not affected.

In the course of studies on substances that attract or repel the flies, it was found that certain volatile compounds, such as acetic acid, restore the attractiveness of old baits if they are exposed so that they do not mix with the bait, but so that the odours of the two substances mingle. Tests of supposed repellents were made by a simple method in which the odour of the substance to be tested was mixed with that of an attractant without altering the composition of the bait. Many substances that have been regarded as repellent were shown to have no true repellent properties, and the only substances that have so far proved repellent are chlorine and iodine. Further work on chemical treatment of baits to render them more attractive [*cf.* **22** 252] suggests that calcium sulphide may be superior to sodium sulphide for this purpose.

Although it is known that the conformation of the breech influences predisposition to breech strike, little has been written about the relative importance of different parts. An attempt was made to assess this by recording the number of strikes on the different parts in a flock of ewes in the field. Nearly 90 per cent. involved the inner breech folds (about 50 per cent. being restricted to them), 6 per cent. started on the tail, and the remainder were distributed between the perineum, the true crutch, and the outer breech area. The large-scale field experiment in Queensland on the effect of Mules' operation in reducing infestation [*cf.* **23** 294] has so far given inconclusive results, but some aged ewes treated at Canberra have shown a decided reduction in the incidence of strike, both as compared with their previous history and with untreated sheep with the same type of conformation. The clinical course and pathology have been studied in controlled artificial strikes and in those occurring under natural conditions. Maggots can produce perceptible injury to the skin in the 4–6 hours after hatching, and by the third day the skin and subjacent tissues are extensively inflamed, the epithelium is denuded over extensive areas, the wool follicles and glands are disorganised, the body temperature has risen to 104–105°F., and the animal is sick and wretched. The temperature rises still further on the fourth day, and at this stage a break may develop in the general body fleece. The maggots begin to drop off on the fifth day, after which the temperature gradually falls to normal and healing takes place by resolution without scarring and without effect on the subsequent growth of a new fleece. One of the chief complications is extension of the strike by maggots deposited later on the highly attractive struck area. Further work on experimental strike showed that, as accessory conditions to the presence of free moisture in the fleece [*cf* **24** 134], inflammatory changes in the skin and bacterial activity are important.

In the treatment of carcasses with powdered poison, it was necessary to find a substance that would be as effective on a dead sheep in full wool as on one that had been shorn or skinned. Borax, diluted with one or two parts of inert dust, was superior to sodium fluoride for the poisoning of a shorn carcass [*cf. loc. cit.*], and just as effective on long-woolled as on shorn animals ; moreover, it is less poisonous to dogs or other animals that may eat the carcass.

In 1932, various races of *Spalangia orientalis*, Graham, and *S. sundaica*, Graham, were liberated in North Australia for the control of *Lyperosia exigua*, de Meij. [*cf.* **20** 259]. A survey during the autumn showed that the parasites have not produced any detectable effect on the abundance of the flies or on the damage they cause to stock.

GIBBINS (E. G.). **Notes on the Breeding Habits of some House-frequenting Flies in Uganda.**—*E. Afr. med. J.* **13** no. 10 pp. 318–323, 8 refs. Nairobi, January 1937.

These notes, which are based on material collected at random during 1932–36, include records of the breeding of *Cordylobia anthropophaga*, Grünb., and *Stomoxys minuta*, Bezzi, in cow-dung, *S. pallida*, Roub., in cow-dung and hippopotamus dung, and *S. nigra*, Macq., in an old heap of decaying grass-cuttings.

KING (W. V.) & LENERT (L. G.). **Outbreaks of *Stomoxys calcitrans* L. ("Dog Flies") along Florida's Northwest Coast.**—*Florida Ent.* **19** no. 3 pp. 33–39, 3 figs. Gainesville, Fla, December 1936.

Severe outbreaks of *Stomoxys calcitrans*, L., occur annually along 200 miles of coast in north-western Florida. The swarms begin to appear during the latter part of August or the first part of September. Holidaymakers are forced to leave the beaches, and many of the bathing resorts close during the fly season, which may last for 2 months or more. Livestock, especially cattle, suffer intensely from the attacks of flies, and the reduction in milk yields at this time is estimated at 20–50 per cent. Investigations on part of the infested coast showed that the fly was breeding in piles of seaweed (two species of *Sargassum*) [*cf. R.A.E.*, B **24** 102] at the edge of a salt-water lake in which the salt content was 2·5 per cent. and in wet depressions along the beach. The larvae were found in the lower part of the piles, which was saturated with salt water, and the pupae in the drier parts. Windrows of the dried and shrivelled plants are common along the beaches, but the flies do not breed in them in the dry state. Along this coast are a number of lakes that lie behind or among the sand dunes. Their outlets through the dunes are usually closed by sand thrown up by the action of the waves, but they are washed open occasionally by storm tides or by flood water after heavy rainfall. If *Sargassum* is present in the surf at such times, it is carried into the lakes at high tide, and some of it becomes stranded just at the water line when the lake returns to its normal level. Closing of the passages by sand prevents further tidal fluctuations that would tend to strand the seaweed so high on the bank that it would become entirely dry. *Sargassum* is not peculiar to this region, but it is thought that its coincidence with these lakes may explain the localisation of the fly outbreaks. In other parts of the infested region, such lakes may not exist and other factors may be responsible. The removal of the piles of seaweed as they accumulate may be a feasible and effective method of controlling the fly.

FRANCIS (E.). **Sources of Infection and Seasonal Incidence of Tularaemia in Man.**—*Publ. Hlth Rep.* **52** no. 4 pp. 103–113, 2 pls., 2 maps. Washington, D.C., 22nd January 1937.

In the course of this review of present knowledge on the subject of tularaemia in man, a brief account is given of its geographical distribution. In the United States, 6,174 cases have been reported; they have occurred in all States except Vermont and Connecticut. Sources of infection are discussed [*cf. R.A.E.*, B **15** 218]; in 53 cases in Montana and the surrounding States infection was traced to *Dermacentor venustus*, Banks (*andersoni*, Stiles), in 65 cases in the

southern States to *D. variabilis*, Say, and in 68 cases in Utah and the surrounding States to *Chrysops discalis*, Will. This fly transmitted the disease to 30 out of 170 men in a camp in Utah in July 1935. A table shows the seasonal and geographical distribution of cases recorded from 1924 to 1935, inclusive, and the agencies responsible for infection in the different months [*cf.* **16** 85]; cases due to *D. variabilis* occurred between January and October.

NEEDHAM (J. G.) & others. **Culture Methods for Invertebrate Animals.**—Med. 8vo, xxxii + 590 pp., 85 figs. Ithaca, N.Y., Comstock Pubg Co., Inc., 1937. Price $4.00.

This work includes sections (pp. 205–518) comprising short contributions by different authors on the rearing and maintenance of Arthropods. Among those dealt with are *Latrodectus mactans*, F., *Dermacentor venustus*, Banks (*andersoni*, Stiles), lice, *Cimex lectularius*, L., and blood-sucking and other noxious Diptera, four contributions being devoted to mosquitos and three to blowflies. The authors' aim was to obtain for at least one species of each Order or considerable group, a fairly complete account of maintenance requirements, covering collecting methods and devices, cages and breeding quarters, plans for feeding and watering and for cleaning and aerating quarters, breeding management, and all else that enters into the maintenance of the species through successive generations. Illustrations of apparatus are given, and references are appended to some of the contributions.

DUKE (H. L.). **Studies of the Effect on *T. gambiense* and *T. rhodesiense* of prolonged Maintenance in Mammals other than Man; with special Reference to the Power of these Trypanosomes to infect Man. V. The Effect of prolonged Maintenance away from Man on the Infectivity of *T. rhodesiense* for Man.**—*Parasitology* **29** no. 1 pp. 12–34, 15 refs. Cambridge, 29th January 1937. **VI. Strain "Kahondera" from Southern Rhodesia, and concluding Observations on this Series of Papers.**—*T.c.* pp. 35–42, 3 refs.

The first two papers of this series have already been noticed [*R.A.E.*, B **24** 250]. In the fifth paper, the author discusses the behaviour of five strains of *Trypanosoma rhodesiense*. Much of the information on three of them has been published previously [**23** 134, 135], but the later history of some of the experimental animals is given here, and the behaviour in man and animals of two new strains received from Tanganyika in 1934 is described.

The sixth paper is the last to be published from the Uganda Research Institute, and after giving an account of a trypanosome (isolated from a native of Gowe in Southern Rhodesia), which possesses some characters of both *T. rhodesiense* and *T. gambiense*, the author briefly discusses the origin of *T. rhodesiense* in the light of the investigations recorded in the present series of papers and makes a few general observations. He considers that the evidence favours the view that *T. rhodesiense* is more closely related to *T. brucei* than to *T. gambiense*, that it is in the process of becoming *T. gambiense*, and that it arises from *T. brucei* when circumstances conduce to broad contact between man and the species of *Glossina* that feed on game.

Thus, human settlement in game country should be carefully supervised to prevent contact with tsetse flies, and, in areas where they are present, should be preceded and attended by measures for eradicating them in a zone round the settlement and round the supplies of wood, water and food.

T. gambiense is the principal trypanosome menacing man in Africa, the harm caused by *T. rhodesiense* being comparatively small. The type of *T. gambiense* in east and central Africa is not well adapted to antelope (much less so than *T. rhodesiense*), and the small amount of information available suggests that it might possibly revert gradually to *T. brucei* in this class of mammal. The actual importance of game to *T. gambiense* in east and central Africa at the present time is probably very slight, for this trypanosome is primarily, if not exclusively, a parasite of man and depends on man for its survival in nature.

HADDOW (A. J.) & THOMSON (R. C. M.). **Sheep Myiasis in south-west Scotland, with special Reference to the Species involved.**—*Parasitology* **29** no. 1 pp. 96–116, 3 figs., 21 refs. Cambridge, 29th January 1937.

In the course of field observations on carrion flies carried out in 1933, one of the authors was impressed by their abundance in certain areas where sheep maggots were prevalent. Since rearing experiments indicated that they were concerned in the production of myiasis in sheep, the more extensive investigations here described were undertaken in various parts of south-west Scotland. The following is taken largely from the authors' summary: Larvae from cases of myiasis were collected by the authors and reared in a fly-proof apparatus, details of which are given. The fly season lasted approximately from May till September and reached its height in July–August. The western districts were the most severely affected. The flies preferred low-lying, sheltered ground, especially where much bracken was present. The methods of burying carcasses were found to be primitive and inadequate. On most of the farms, dipping was carried out without sufficient attention to cleanliness or to duration of immersion. The hibernation of various species of blowflies was studied. They were found to pass the winter as prepupae; pupation never occurred normally until April or May. Several species of carrion-feeding blowflies other than *Lucilia sericata*, Mg., occasionally caused secondary myiasis in certain districts, mainly in the west. The species were *L. caesar*, L., *Calliphora erythrocephala*, Mg., *C. vomitoria*, L., *L. illustris*, Mg., *Phormia* (*Protophormia*) *terraenovae*, R.-D., and *Muscina pabulorum*, Fall., of which the last four have not previously been recorded from sheep. Records of cases in which these flies occurred are given.

MELLANBY (H.). **Experimental Work on Reproduction in the Tsetse Fly,** *Glossina palpalis*.—*Parasitology* **29** no. 1 pp. 131–141, 2 figs., 10 refs. Cambridge, 29th January 1937.

MELLANBY (K.) **The Reproductive Cycle in** *Glossina morsitans* **and** *Glossina swynnertoni*.—*T.c.* p. 142, 2 refs.

In the first paper, the author describes experiments carried out in Uganda in 1935 to determine the effect of temperature, humidity and

nutrition on the reproductive cycle of *Glossina palpalis*, R.-D. [*cf.* *R.A.E.*, B **25** 92]. The following is mainly taken from her summary: At an average temperature of 24°C. [75·2°F.] and a relative humidity of about 70 per cent., the first egg (which is invariably the lowest one in the right ovary) is ripe in 7 days. Ovulation of this egg never occurs earlier than the 8th day, and frequently later; it bears some relation to fertilisation, for in virgin females it failed to occur for weeks. The first larva was produced in a variable time after fertilisation (because of delayed ovulation), but the succeeding larvae were produced very regularly, with an average period of 9·9 days between them. Ovulation occurred within 24 hours of the production of the previous larva. The embryonic period was 3½ days and the larval period 5. Pupae produced in the laboratory usually weigh less than those collected in the field. Apparently flies must take large meals at the right stage of gestation to produce large pupae, and it is impossible to ensure that this happens with all flies in the laboratory. Abortions are caused in captivity by flies obtaining too little blood. They were induced in pregnant females by allowing them to take only small meals, in which case either an egg or a small larva was extruded. When these flies were properly fed later, they produced normal larvae. If exposed to a constant temperature of 30°C. [86°F.], females become sterile, ovaries develop abnormally and eggs fail to hatch, but young larvae (in the uteri) are not adversely affected. At a constant temperature of 22°C. [71·6°F.], the rate of development of the eggs in the ovaries is retarded and the larval period is prolonged. Experiments at this temperature are complicated by the inactivity of the males, which leave many females unfertilised. The length of the combined embryonic and larval periods is 17½ days. Experiments out of doors suggest that the period between the deposition of each larva in the field during December (when the temperature ranges from 16 to 27°C. [60·8 to 80·6°F.]) will be about 13½ days. Flies appear to breed equally well at relative humidities of 47, 88 and 100 per cent. In the drier air, care must be taken with feeding or the flies die from desiccation. At a temperature of 20°C. [68°F.], pregnant females can retain their larvae for an extra 12 hours, but not longer.

In the second paper, the author states that he was able to investigate the reproductive cycles in *G. morsitans*, Westw., and *G. swynnertoni*, Aust., in Tanganyika, and comparison with that of *G. palpalis* showed that the three were almost identical. It is therefore probable that all species of tsetse flies have a similar cycle.

MELLANBY (H.) & MELLANBY (K.). **Rearing Testse Flies in Captivity.**—*Proc. R. ent. Soc. Lond.* (A) **12** pt. 1–2 pp. 1–3, 5 refs. London, 15th February 1937.

The breeding of tsetse flies in the laboratory is discussed, and it is pointed out that they have never been bred in large numbers over any length of time. Provided that females have been fertilised, the successful production of pupae depends on careful feeding. The method of keeping the flies in a cage with a suitable host has always proved unsuccessful. The method in which batches of flies, or single flies in tubes, are put into direct contact with a host appears to be the only one by which any number of flies can be kept alive. Moreover, it is not sufficient merely to give them an opportunity to feed for,

say, 15 minutes every day, even though flies in nature probably feed only once every 4 or more days and the process of feeding takes under 2 minutes. In captivity, flies that are definitely "physiologically hungry" and contain less reserve materials than those that in nature seek a blood meal often refuse food for some considerable time. If, however, such flies are put repeatedly in contact with a source of food, they can usually be induced to feed. It is thus possible to keep almost all the flies alive for at least three months after emergence, provided that they have not been injured during the pupal stage. The effect of temperature and humidity on survival is discussed [*cf.* preceding paper]. Different types of containers have been used. Celluloid cylinders with gauze ends were found convenient for keeping batches of 15–20 flies. To obtain the best results, flies that did not feed when the batch was placed in contact with a host and looked as though they required a blood meal were removed, and attempts were made to induce them to feed individually. Flies survived longest when kept separately in tubes ($2 \times 1\frac{1}{2}$ inches) with gauze tops, containing a piece of blotting paper to absorb the copious excrement. When a number of females are kept together with a very few males, many of them may remain unfertilised indefinitely. They are most attractive when they are between 5 and 8 days old, and it is necessary to have a great excess of males when they are at such an age to obtain even approximately 100 per cent. fertilisation. Males are potent at any time after they are 5 days old, but they seldom try to pair with females over 10 days old. Pairing lasts at least half an hour, and fertilisation has not occurred when pairs separate after a few minutes. Adults that emerge from small laboratory-bred pupae are themselves undersized but are capable of producing offspring. Four generations of *Glossina palpalis*, R.-D., were bred in London, and at the end of the experiment the population was slowly increasing. The longest period for which a female survived in captivity in these experiments was 215 days ; 208 days had elapsed since it was fertilised but at death its spermathecae still contained motile spermatozoa.

MARSHALL (J. F.) & STALEY (J.). **Some Notes regarding the morphological and biological Differentiation of** *Culex pipiens* **Linnaeus and** *Culex molestus* **Forskål (Diptera, Culicidae).**—*Proc. R. ent. Soc. Lond.* (A) **12** pt. 1–2 pp. 17–26, 2 figs., 17 refs. London, 15th February 1937.

Further work on the so-called autogenous and non-autogenous races of *Culex pipiens*, L., has led the authors to confirm their view that they should be regarded as distinct species [*cf. R.A.E.*, B **24** 22], but to modify to a certain extent their conclusions as to the characters by means of which they may be distinguished [*cf.* **24** 19]. The reasons for applying the name *C. pipiens*, L., to the non-autogenous race that does not attack man, and the possible names that might be used to designate the autogenous races are discussed. Of these, the name *C. molestus*, Forsk., is selected as the earliest.

THORNTON (Sir E. N.). **Malaria.**—*Rep. Dep. publ. Hlth S. Afr.* ***1935–36*** pp. 31–37. Pretoria, 1936.

In most areas of Natal and Zululand, the year under review (beginning in July 1935) was preceded by a prolonged drought, which continued

until early in February 1936. During February and March, the hot, humid weather and frequent showers produced ideal conditions for breeding of *Anopheles gambiae*, Giles, which had previously been confined to the river valleys and certain low-lying areas, with the result that it began to extend rapidly. Towards the end of February, adults were numerous in houses, particularly in the inland and coastal areas of Zululand and certain low-lying areas on the coast of Natal. In March, breeding was prolific, especially in the previously drought-stricken areas of Zululand and in the north-eastern districts of Natal, where no organised measures of control had been instituted. Figures showing the number of blood smears positive for malaria indicate that the general incidence of the disease was the lowest for five years and has been reduced to very small proportions; they also suggest that the vector has thus much less opportunity of becoming infected. This is supported by dissections, which showed that the infectivity rate in mosquitos taken in huts in formerly intensely malarious areas that are now being sprayed weekly with insecticide, was under 0·5 per cent. [*cf.* *R.A.E.*, B **24** 77]. The control measures adopted were the application of oil against larvae and the spraying of huts against adults. The intervals between applications are now being regulated by local observations on the breeding of the vectors, *A. gambiae* and *A. funestus*, Giles, and the cost should thus be brought down to the most economic level consistent with efficiency. The benefits of this procedure have been demonstrated during the past season, since in some areas it was necessary to spray three times a week, whereas in others little or no oiling or spraying was needed. This is largely due to the fact that sugar-cane, the chief crop, is cut only once in two years, so that in one year the land is covered with thick vegetation and is therefore harmless, and the next it is bare and may provide numerous breeding places for *A. gambiae*. The incidence of malaria was greater in the northern districts of Natal than during the past three years, but efficient weekly spraying in the native reserves prevented epidemic malaria in every case in which it was instituted, and spraying twice weekly practically eliminated fresh infections. During the season, systematic weekly spraying was undertaken in 16,000 huts, representing a population of some 50,000 natives, in areas heavily infested with *A. gambiae* and, in one section, with *A. funestus* also, and 6,000 gallons of spray material were used. The fact that only 2,500 gallons of oil were used shows the extent to which measures against adult mosquitos have superseded those against larvae. Since they were instituted, only sporadic cases of malaria have occurred, although all sections were intensely malarious in the past. In one uncontrolled area, infestation became intense and the position appeared serious, but spraying established complete control within a month. Some 130 acres in swampy or water-logged sections of the reserves were ploughed and planted with *Eucalyptus saligna* during the year. A continuation of this policy on a more extended scale will in time not only abolish breeding places of *A. gambiae* but will also profitably utilise land that is now of little value.

Booker (C. G.). **Annual Report of the South African Railways and Harbours Organisation, 1935–1936.**—*Rep. Dep. publ. Hlth S. Afr.* ***1935–36*** pp. 93–121. Pretoria, 1936.

Anti-malaria work in the Transvaal and Natal was continued on the same lines as in previous years [*cf.* *R.A.E.*, B **24** 77; **23** 9].

As a result of the abnormal rainfall, the Komati River (Transvaal) was flooded for the greater part of the season, and islands in the middle were at times completely submerged. When the floods receded, the collections of water that remained on the islands formed ideal breeding places for larvae of *Anopheles gambiae*, Giles. Owing to the force of the water and the fear of crocodiles, these could not be treated for some considerable time, and as a consequence both the catches of mosquitos and the incidence of malaria increased in Komatipoort. Both in the Transvaal and Natal, conditions were favourable for an intense and widespread epidemic of malaria, but control measures were intensified, dwellings were sprayed twice or thrice weekly, and in some areas the radius of larval control was increased. The success of the campaign is shown by the fact that, although the numbers of adults of *A. gambiae* caught in this and the previous year were in the ratio of 1,694 to 6, there were only 40 as against 90 cases of malaria for the same periods, respectively. The number of cases of malaria contracted by employees on night shift confirmed the observations of previous years that the estimate that in more than 90 per cent. of the cases infections with malaria are contracted in bedrooms is greatly exaggerated; and the use of a repellent was advocated for those on night duty. From October 1935 to May 1936, 2,609 larvae and 9,339 adults of *A. gambiae*, 16 larvae and 36 adults of *A. funestus*, Giles, and 4,238 larvae and 925 adults of other Anophelines were collected [*cf.* **24** 77]. A table shows the amount of draining, filling, clearing and planting carried out. It is anticipated that all houses in malarious areas in the Transvaal will be satisfactorily screened at the beginning of the next malaria season. In spite of the unprecedented conditions that had to be contended with, the malaria incidence again dropped during the period under review. In two localities where the breeding of *A. funestus* had been the chief problem in previous years, the systematic clearing of vegetation from the river and streams within the controlled areas and the planting of gum trees [*Eucalyptus*] to absorb seepages has now rendered danger from this vector negligible. As a result of these measures, supplemented by oiling and spraying, no malaria occurred within the controlled areas.

Toumanoff (C.). **L'anophélisme en Extrême-Orient. Contribution faunistique et biologique**—*Coll. Soc. Path. exot. Monog.* **4** 434 pp., 75 figs., 176 refs. Paris, Masson & Cie, 1936. Price *Frs.* 60.

In this monograph, the author presents the results of 4 years' work on the Anophelines of Tonkin and southern Indo-China, undertaken with a view to collecting in the field the data necessary for determining the species responsible for the transmission of malaria in different parts of the country and the measures that may be used to control them.

The first part consists of an introductory chapter giving details of the methods of work and notes on the system of classification (including keys to the larvae and adults of the species found in Indo-China), a chapter on the Anophelines of the different regions of Tonkin, and one on those of the coastal regions. The second part consists of only one chapter, which deals with the bionomics of the species, including breeding places, the period of reproductive activity, the length of the larval period, and the daytime resting places of the

adults. The third part is divided into two chapters in which infection in Anophelines and the part played by the different species in the transmission of malaria are discussed, and the feeding habits of the different species are considered in relation to their ability to act as vectors.

CHANG (Teh-ling). **Further Notes on the Maxillary Teeth of** *Anopheles hyrcanus* **var.** *sinensis* **Wiedemann in Shanghai Region.**—*Lingnan Sci. J.* **16** no. 1 pp. 5–8, 5 refs. Canton, January 1937.

The results of precipitin tests of 1,604 examples of *Anopheles hyrcanus* var. *sinensis*, Wied., from various types of shelter in the Kaochiao region [*R.A.E.*, B **24** 46] are compared with the maxillary indices found for 500 of the same batch [**24** 255]. All the 193 examples taken in a man-baited trap were positive for human blood, and the average maxillary index of 89 of these was 16·7. The average index was the same for 26 examined out of a batch of 75 taken in an empty privy, of which 59 were positive for cow blood and only 1 distinctly positive for man. Thus these two batches do not appear to show any correlation between blood-preferences and maxillary indices. An examination was also made of the maxillary indices of batches of mosquitos that had been shown by precipitin tests in another experiment [**24** 191] to have fed on man, cow, fowl, cat, pig, dog and goat, respectively. The average indices ranged from 17·88 to 17·19. Those that had fed on man showed the highest average, even those that had fed on cows showing a lower one (17·79). Thus there again appears to be no correlation between food-preference and maxillary index. It is suggested that the explanation may prove to be intensity of competition [*cf.* **16** 210].

[IVANOVA (L. V.).] **Иванова (Л. В.). État de repos et mouvements de la larve d'***Anopheles mac. messeae* **Fall.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 474–484, 5 graphs. Moscow, 1936. (With a Summary in French.)

A detailed account is given of laboratory observations in Moscow on the movements of fourth-instar larvae of *Anopheles maculipennis*, Mg., race *messeae*, Flni., under the influence of light, wind, temperature, and in the presence or absence of solid objects in the water. At 17–19°C. [62·6–66·2°F.] and in diffused light, the larvae remained almost all the time on the surface of the water, being usually attached to some solid object, and only occasionally descended deeper. Their activity and reaction to irritation were reduced when the light or temperature was decreased ; whereas they moved and dived incessantly under the influence of strong light and they darted on the surface of the water at the least touch at 13–25°C. [55·4–77°F.]. A ripple caused by wind made them descend to the bottom, sometimes for as long as 10 minutes. The larvae are positively thigmotropic, as, in all the experiments, they ceased to move about spontaneously on coming into contact with a solid object. If, however, the jar was heavily shaded, they remained practically motionless even if not in contact with solid matter.

[Ivanova (L. V.).] **Иванова (Л. В.). Sur l'influence de la lumière sur la conduite des larves d'*Anopheles maculipennis* Mg.** [*In Russian.*] —*Med. Parasitol* **5** no. 4 pp. 485–499, 1 fig., 10 graphs. Moscow, 1936. (With a Summary in French.)

Laboratory observations on fourth-instar larvae of *Anopheles maculipennis*, Mg., showed that any change in the conditions of light has a marked effect on their behaviour. When the light was increased, larvae on the surface of the water moved about in jerks almost incessantly and frequently dived. When, however, they accidentally came into a shaded part of the container, they became almost inactive; as a result, practically all of them gradually congregated in the shade. This was due to photokinesis and not to negative photo- or thermotaxis, since larvae that moved about in the shaded water did not turn back on reaching the water exposed to light and their distribution was not affected by altering the temperature of the water. In diffused light, the larvae were much less active and distributed themselves almost evenly in the shaded and lighted parts of the container. After a long exposure to bright light, the larvae gradually became less active.

Larvae that had dived exhibited a marked positive phototaxis, invariably moving towards the light even when the water was illuminated from below or at the side. In spite of this, however, they eventually rose to the surface of the water. In nature, the positive phototaxis would make it easier for ascending larvae to find free spaces on the surface of water overgrown with vegetation. Red light had the same effect on the larvae as darkness and did not provoke either phototaxis or photokinesis.

[Bekman (A. M.).] **Бекман (А. М.). L'influence de la température sur l'intensité de la filtration de la larve d'*Anopheles maculipennis messeae*.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 500–505, 2 graphs, 9 refs. Moscow, 1936. (With a Summary in French.)

An account is given of experiments in Moscow on the effect of temperature on the feeding of larvae of *Anopheles maculipennis*, Mg., race *messeae*, Flni. The larvae were collected in the field and allowed to moult to the fourth instar in the laboratory. The observations were made 6–24 hours after moulting, this being the time when maximum filtration takes place. The larvae were able to feed by filtration within temperature limits of 8–37·5°C. [46·4–99·5°F.]. At 19–30°C. [66·2–86°F.], they filtered almost without interruption and the rapidity with which the brushes moved exceeded 3·33 strokes per second. At higher or lower temperatures, the rapidity and frequency of filtration decreased, until, at 2·5 or 40°C. [36·5 or 104°F.], the larvae only made a few strokes with their brushes for short periods. Larval mortality was greater at temperatures above the optimum than at those below.

Since it had been found in the course of previous investigations [*R.A.E.*, B **24** 71] that the larvae feed in the absence of light, the present experiments suggest that larvae in nature will not cease feeding at night during the summer, or, in most cases, during the spring and autumn. Dusting with Paris green in the evening should not, therefore, be considered useless.

[Popov (V. M.) & Ferri (L. V.).] **Попов (В. М.) и Ферри (Л. В.). L'action du vert de Paris sur les larves d'*Anopheles maculipennis* aux températures basses.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 506–509. Moscow, 1936. (With a Summary in French.)

The common belief that Paris green is ineffective against larvae of *Anopheles maculipennis*, Mg., if the temperature is as low as 10°C. [50°F.], since the larvae do not feed at this temperature, was shown to be incorrect in field experiments carried out on a large scale in August 1935 in a district of western Siberia where the climate is cold. The temperature of the water at the time of dusting was 6–9°C. [42·8–48·2°F.], and complete mortality of the larvae of all instars was produced in 6–8 hours, whether the dust was applied by aeroplane or with a hand duster. All the dead larvae dissected had grains of Paris green in the stomach. This showed that the larvae can adapt themselves to a cold climate and feed at low temperatures. The larvae swallowed particles of the poison at night during complete darkness, as well as by day. Larvae of *Dixa* were killed as well as those of *A. maculipennis*, and it is thought that the effect of a dust on them may serve to indicate its effect on Anopheline larvae, if the latter are scarce and difficult to observe.

[Polezhaev (V.).] **Полежаев (В.). La réaction à la lumière chez les femelles hibernantes d'*Anopheles maculipennis messeae* Fall.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 510–524, 7 graphs, 5 refs. Moscow, 1936. (With a Summary in French.)

The effect of light on females of *Anopheles maculipennis*, Mg., race *messeae*, Flni., that were about to enter hibernation was studied in Moscow, the mosquitos being placed in muslin cages or glass boxes. In general, they tended to settle on the highest part of the cage, on the under surface of the top if it was rough enough, or on the upper part of the sides if the cage was a glass box. They also congregated in the part of the cage nearest to the source of light. In experiments carried out by V. N. Beklemishev, the mosquitos were always more attracted by a large illuminated surface (such as a window) than by a small though brighter light. The author's observations showed that when the mosquitos are disturbed, they immediately make towards light in search of an exit, this instinct for escape being connected with positive phototaxis. An evenly distributed light without any shade provokes this reaction. When disturbed in a cage of which half was shaded, the mosquitos at first dashed towards the light, but in about ten minutes most of them passed into the dark part, where they remained. This was due, not to negative phototaxis, but to the interruption of the activity provoked by the light (photokinesis). Activity due to light was more marked and less readily interrupted in individuals that had been kept without water. When given the choice of a black and a white surface, most of the females with a developed fat-body alighted on the former, being probably affected by the black colour in the same way as by reduced light.

[Detinova (T. S.).] **Детинова (Т. С.). Certains éléments de la conduite des femelles d'*Anopheles maculipennis messeae* Fall.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 525–543, 4 graphs, 14 refs. Moscow, 1936. (With a Summary in French.)

The factors affecting oviposition by females of *Anopheles maculipennis*, Mg., race *messeae*, Flni., that have matured their eggs were

studied in Moscow, the mosquitos being collected in a peat-bog locality in the neighbourhood. Only those that had just completed the gonotrophic cycle were used in the experiments, which are described in detail. When kept under dry conditions in the absence of water, over 85 per cent. of the females died without laying eggs. In the others, oviposition only began after 24 hours and was not completed, even though it was sometimes continued for 5 days. On the other hand, mosquitos placed on water, with part of their wings cut off to prevent them from flying away, began to lay eggs in about 2 minutes and always completed oviposition. Oviposition was also induced by wet filter paper, though less readily than by the free water surface. Apparently, the presence of water is able to stimulate oviposition without the female being in direct contact with it, since eggs were sometimes dropped into the water from a distance of 1–6 ins. while the mosquitos rested on the wall of the cage. Observations in the laboratory and in nature suggest that females ready to oviposit may wait for several days before actively seeking water, but oviposit as soon as they come in contact with it, whether accidentally or otherwise. Mosquitos were sometimes able to find water and oviposit in complete darkness, but sight must be of some importance in choosing the place for oviposition. Thus, under ordinary conditions in the insectary, the females definitely preferred to oviposit in water, coloured orange with a tasteless and odourless dye.

Since it was observed that, before ovipositing, the mosquitos usually drink from the water on which they have alighted, experiments were carried out to determine whether they are guided by taste in selecting waters for oviposition. The results showed that eggs were laid on water from which the mosquitos drank, and not on that from which they immediately withdrew the proboscis. In nature, the mosquitos probably leave distasteful water immediately, but presumably oviposit if they cannot detach themselves from the surface, as eggs have been found on films of crude oil. In the tests, slightly acid water was preferred to pure tap water, and the latter to salt water ; and only a few eggs were laid on alkaline or strongly acid water. The bitter taste of water treated with quinine did not repel the mosquitos ; they were found to have ingested it and the number of egg batches deposited was actually greater than that laid on tap water. It is probable that their selective ability does not include a taste that they do not encounter naturally.

[Polezhaev (V. G.).] **Полежаев (В. Г.). L'influence de la lumière sur la distribution des** *Anopheles maculipennis* **dans les abris de jour.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 544–548, 2 figs. Moscow, 1936. (With a Summary in French.)

The distribution of *Anopheles maculipennis*, Mg., in day-time shelters was studied in a village in the environs of Perm. Cow-sheds and stables were examined, and in each case the temperature, humidity and intensity of light in the four corners and in the centre were measured. The weather was wet, and, in the sheds and stables, the humidity was high, the mean temperature varied little and there were practically no draughts ; the intensity of light was, therefore, the decisive factor that affected the distribution of the mosquitos. They always occurred in the upper parts of the sheds, but were evenly distributed if the light was evenly diffused, whereas if it was not,

most of them congregated in dark places, this being due to photokinesis. In some cases, however, this inverse correlation with light intensity was broken owing to the presence of animals to which the mosquitos were attracted, or to cracks in the walls, which they avoided. A table shows how the average numbers of mosquitos decreased regularly with an increase in the intensity of light, which varied from 0·15 to 195 lux.

[SIMACHKOVA (M. S.).] **Симачкова (М. С.). The Factors influencing the Distribution of the Mosquitoes** *A. maculipennis* **in the diurnal resting Places.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 549–565, 6 graphs, 11 refs. Moscow, 1936. (With a Summary in English.)

Observations on the distribution of the adults of *Anopheles maculipennis*, Mg., in day-time shelters carried out in June–September 1935 in the Mariĭsk area (former Department of Kazan) confirmed the results of investigations elsewhere [*R.A.E.*, B **22** 76]. The animal quarters examined are described, and the distribution of the mosquitos in them, depending on temperature, humidity, light and the degree of blood digestion, is shown in tables. It is concluded that the composition of the mosquito population in the shelters is chiefly determined by their proximity to, or remoteness from, the breeding places, their accessibility, the presence or absence of a host [*cf.* **23** 114], and their microclimate. In the absence of wind and direct sunlight, and at the usual summer temperatures, the numbers of mosquitos in a shelter or part of one increase with the relative humidity, provided that it is below 65 per cent. When, however, the relative humidity exceeds 65 per cent., their numbers vary inversely with the amount of draught and the intensity of light. The mosquitos usually rest on, or close to, the ceiling, but at higher temperatures (24–26°C. [75·2–78·8°F.]) the percentage that congregates on the walls and nearer to the floor markedly increases, provided that the temperature is lower below than above. A strong negative reaction to light is shown by freshly engorged mosquitos, whereas those that have not fed or have completely digested the last blood-meal chiefly occur in the most illuminated parts of the buildings and are much more active. Individuals with partly digested blood occupy an intermediate position. Those with a developed fat-body and completely digested blood usually occur in unoccupied animal quarters, the presence of a host being of no importance to them, and tend to congregate in dark places.

[DETINOVA (T. S.).] **Детинова (Т. С.). Les changements saisonnières chez les femelles d'***Anopheles maculipennis messeae* **Fall.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 566–567. Moscow, 1936.

Laboratory observations in 1935–36 on the oviposition of females of *Anopheles maculipennis*, Mg., race *messeae*, Flni., taken in the environs of Moscow, showed that their fecundity varies with the time of year [*cf. R.A.E.*, B **19** 122]. The figure taken to indicate fecundity for the different months was the average number of eggs laid by, and remaining in the ovaries of, females that had oviposited once. The results are given in a table, which shows that the figures are highest (185·1–244·4) for females of the summer generation (June–July).

The figure for the overwintered generation, which oviposits in May, was 130·85 and was practically the same as those for mosquitos that oviposited in the winter months in the laboratory.

[Kalandadze (L. P.) & Lemer (M.).] **Каландадзе (Л. П.) и Лемер (М.). Sur l'emploi du chloropicrine contre les larves des moustiques.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 568–578, 6 refs. Moscow, 1936.

Field and laboratory tests of the value of chloropicrin against mosquito larvae and pupae [*cf. R.A.E.*, A **21** 257; **22** 195] were carried out in August–October 1933 and 1934 in the environs of Tiflis. When placed in a receptacle at the bottom of the water, it was effective in the laboratory, but not in the field [*cf.* **21** 258]. On the other hand, when sprayed at the rate of 0·05, 0·1 or 0·3 gm. per litre, it killed all the larvae and pupae, and the water remained free from infestation for 4–5 days when the rate was 0·05 gm. and for 7–10 days when it was 0·1 or 0·3 gm. Complete mortality of larvae and pupae was also obtained in all tests by broadcasting sawdust moistened with chloropicrin; when the rates of application were 0·1 and 0·3 gm. per litre, the toxic action lasted 5–6 and 10–12 days, respectively. The authors believe that chloropicrin acts on the larvae and pupae as a contact poison, as it practically does not dissolve in water when submerged, its toxic effect ceases in about 5–10 days after surface application, and it was not effective when tested as a stomach poison in a mixture of flour, road dust and kerosene [*cf.* **22** 195]. Politov stated that it is soluble in water to the extent of 10·65 gm. per litre at 18°C. [**21** 257], but according to the literature, the figure should have been 1·65 gm. It killed some aquatic plants and animals, including *Gambusia*; but a dog and ducks were not affected by drinking treated water. Estimates are given of the costs of treating a large area of shallow water with chloropicrin, various oils and Paris green; the cost for chloropicrin is far the highest.

[Danilova (M. I.) & Lappin (G. I.).] **Данилова (М. И.) и Лаппин (Г. И.). Sur le transport des** *Gambusia*. [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 579–583, 5 refs. Moscow, 1936. (With a Summary in French.)

Experiments to find the optimum conditions for transporting *Gambusia* were carried out in Sukhum in 1935. It was found that, for a journey of up to 8 days, the fish may be kept at the rate of 20 per litre of water [90 per gal.] in open receptacles, allowing free access of air, at a water temperature not exceeding 13–16°C. [55·4–60·8°F.]. Covered receptacles stocked with fish at the same rate should be only half filled with water, and the water in them should be kept cool, since the mortality among the fish is low at 6–8°C. [42·8–46·4°F.], whereas almost all die at 14–20°C. [57·2–68°F.]. In all cases, dead fish should be removed as often as possible. Other conditions being equal, the best receptacles are those that expose the largest area of water surface to the air. The fish can withstand starvation for considerable periods. Special experiments showed that they are not affected by the presence in water of iron oxide from rusty containers, etc. [*cf. R.A.E.*, B **22** 194, etc.]. They thrived in water with a salinity of up to 1·5 per cent. [*cf.* **22** 21], provided that there

was suitable aquatic vegetation; in the absence of the latter, they began to die at a salinity of 1 per cent.

On the basis of these experiments, about 180,000 fish were transported in large wooden barrels by steamers from Sukhum to Rostov-on-Don, and from there to a number of districts. They multiplied in various collections of water in the course of the summer and migrated under the ice in December.

[YATZENKO (F. I.) & TISHCHENKO (O. D.).] **Яценко (Ф. И.) и Тищенко (О. Д.). Material for the Study of the Varieties of the Malaria Mosquitos** *A. maculipennis* **Mg. in the Ukraine.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 629–630. Moscow, 1936.

Examination of over 3,000 batches of eggs laid by females of *Anopheles maculipennis*, Mg., taken in 12 localities in and near towns in the eastern half of the Ukraine in the summer of 1934 showed that 58·5–99·97 per cent. of the mosquitos belonged to race *messeae*, Flni. The other races included *maculipennis* (*typicus*), which occurred in 3 localities, and *atroparvus*, van Thiel, and an undetermined form of the *atroparvus-labranchiae* group, which were scarce. Only a single individual of *A. sacharovi*, Favr, which is regarded as one of the races, was taken (in the south).

[YATZENKO (F. I.) & L'VOVICH (M. YU.).] **Яценко (Ф. И.) и Львович (М. Ю.). Material for the Characteristics of** *Anopheles maculipennis messeae*, **Fall. found in the Environs of Kharkov.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 pp. 630–631. Moscow, 1936.

The morphological characters of the adults of *Anopheles maculipennis*, Mg., race *messeae*, Flni., in the Ukraine are briefly discussed. This was the predominant race in the environs of Kharkov in 1935; *maculipennis* (*typicus*) was observed in small numbers in spring and summer, but not in autumn. The females abandoned their hibernation quarters in numbers in the last ten days of April and oviposited early in May. The first adults of the new generation emerged on 31st May. In summer, the mosquitos chiefly occurred in the proximity of domestic animals and remained for some time in the quarters in which they had fed. Water in flooded meadows, usually close to forests, was preferred for oviposition. The formation of fat-body began in August, and feeding and ovarian development ceased at the end of October, at which time also the males disappeared. The last larvae of the fourth instar were observed on 3rd November. Hibernation occurred in cellars at temperatures of from 5·5 to −4°C. [41·9–24·8°F.] and a relative humidity of 80 per cent.

[MASLOV (A. V.).] **Маслов (А. В.).** *Anopheles maculipennis* **dans la province de l'Extrême Orient.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 p. 631. Moscow, 1936. (With a Summary in French.)

Both *Anopheles maculipennis*, Mg., and *A. hyrcanus*, Pall., occur in the Russian Far East, but the former is present in the western half of the Province and the latter in the eastern half, though they are found together in one central district. All the egg batches of *A. maculipennis* examined belonged to race *messeae*, Flni., which appears to be predominant in this most eastern part of the area of its distribution.

[SELEZNEVA (M. V.).] **Селезнева (М. В.). A Case of Infestation of the auditory Duct by** *Wohlfahrtia* **in the Environs of Perm.** [*In Russian.*]—*Med. Parasitol.* **5** no. 4 p. 632. Moscow, 1936.

A case is recorded of the infestation of the external auditory canal of a child in the district of Perm by several larvae of *Wohlfahrtia magnifica*, Schin., which were in the third instar when removed. It occurred in September 1931 ; this fly had not previously been recorded in European Russia further north than the Bashkir Republic.

PAPADAKIS (A. M.). **Three aspects of Leishmaniasis (Kala-azar, Oriental Sore) : parasitological, experimental, entomological. The Species of** *Phlebotomus* **of Greece.** [*In Greek.*]—*Iatr. Athen.* [Med. Athens] nos. 84–87 reprint 40 pp., 94 refs., 13 figs. Athens, 1936.

In the first part of this paper, the author reviews the literature on leishmaniasis, and on the biology of the causal organisms, particularly those of the dermal and visceral forms of the disease in the Mediterranean basin. The various theories on the transmission of the disease are discussed in detail in the second part. In the third, after giving an outline of previous work on sandflies in Greece, the author records his own observations on their distribution, based on the collection of 1,600 specimens over a period of three years, and describes the results of an experiment carried out in the Peloponnesus on the biology of *P. papatasii*, Scop., *P. major*, Ann., and *P. sergenti*, Parr., with special reference to the effect of light, darkness, humidity, etc.

The species found were *P. papatasii*, *P. major*, *P. tobbi*, Adl., Thdr. & Lourie, *P. chinensis*, Newst., *P. sergenti*, *P. sergenti* var. *alexandri*, Sinton, *P. minutus*, Rond., *P. parroti*, Adl. & Thdr., and *P. perfiliewi*, Parr. (*macedonicus*, Adl.). Descriptions are given of the distinguishing features of the male terminalia of all these sandflies and of the spermathecae of the females of the first five.

PAPADAKIS (A. M.). **The Influence of the Salinity of the Water on the breeding of Anopheline Larvae.** [*In Greek.*]—*Iatr. Athen.* [Med. Athens] no. 85 reprint 7 pp., 7 refs. Athens, 1936.

During 1933, experiments were carried out at the Kavalla laboratory on the rearing of the larvae of *Anopheles sacharovi*, Favr, and *A. maculipennis*, Mg., under different conditions, 4,890 first-instar larvae being divided into groups and kept in the sun, in shade, in water of various degrees of salinity, etc.

Larvae of the former were easier to rear than those of the latter. The most favourable degree of salinity for *A. sacharovi* was 6 parts NaCl per mille and for *A. maculipennis* 0·5–2 parts, the upper limits of salinity being, respectively, 18 and 6 parts in the sun and 16 and 5 parts in the shade. The rate of mortality rose and, within certain limits, the length of the larval stage decreased as the salinity increased. Excess of salt in the water had no effect on the head pattern of the larvae [*cf. R.A.E.*, B **25** 89].

The mean day temperature of the water in the receptacles was 23·7°C. in the shade [74·66°F.] and 26·7°C. [80·06°F.] in the sun up to

11 a.m. In the middle of the day the receptacles in the sun were removed to a shelter for three hours, as otherwise the larvae were killed.

Papadakis (A. M.). **Researches on the Biology of** *A. superpictus* **in northern Peloponnesus from March to October 1934.** [*In Greek.*]—*Iatr. Athen.* [Med. Athens] nos. 89–90 reprint 22 pp., 9 refs. Athens, 1936.

An account is given of an investigation undertaken from March to October 1934 in a town and 16 villages in northern Peloponnesus on the biology of *Anopheles superpictus*, Grassi, which is the chief malaria vector of the region.

The overwintered females oviposited during the first half of April; the first eggs were found in nature on the 7th, the first young larvae on the 20th, and adults of the first generation at the beginning of May. The average number of eggs in a batch during the whole period was 112, but during the period of greatest egg production (15th June–15th September) it was 128. The numbers of eggs decreased after 15th September, and no oviposition was observed in October. At the beginning of the season the larvae were usually found only in low-lying breeding places, whereas when the weather became warmer they occurred at higher levels. During August and September, they were ubiquitous, but were more prevalent in torrents in the hills than in breeding places on the plain. Larvae from the higher situations were more resistant than the others to such factors as sun, warmth, etc., and were more active, both in nature and in the laboratory; moreover, they were not so easily or quickly killed when the water was dusted with Paris green. Paris green appears to have rather less effect on larvae of *A. superpictus* than on those of *A. maculipennis*, Mg., and *A. sacharovi*, Favr.

At the beginning of the season, adults were found in houses and stables in lowland areas, and later in those in higher situations. They were widely distributed in August and September, but became less so in October when the temperature was falling. Observations in a mountainous village, 1,640 ft. above sea level, showed that twice as many females were caught in stables as in houses; they were taken in larger numbers in catching stations when animals or man had been present in them during the previous night. They did not seem to prefer man to animals, and their abundance in buildings appeared to depend on the suitability of the shelter and the accessibility of a blood meal. It was found by means of precipitin tests that 44·7 per cent. of females caught in bedrooms contained human blood and 55·2 per cent. animal blood (horse and sheep), whereas all those in stables contained animal blood. The general malaria infection rate was 1·5 per cent. in September and was a little higher in females taken in stables than in those taken in houses. The inhabitants of certain villages go with their animals to villages in the hills for two or three months during the hottest part of the year (August–September), and catches made in the empty houses and stables revealed only a few Anophelines, although it is the season during which they are most prevalent. Far larger numbers were obtained when the inhabitants returned, although the temperature was beginning to fall (pre-hibernating period). Undoubtedly the presence of man and animals attracts the mosquitos to a great extent. In villages in high situations

A. superpictus was only prevalent for two months, whereas in those on the plains or near the sea it was abundant for four. Although several catching stations of the same type were placed along the bank of a large torrent, in only one were males of *A. superpictus* found in large numbers throughout the season. In this one, the proportion of males to females was 5 : 1 ; when pigs were kept there overnight, the total number of mosquitos was increased but males still predominated. This station appeared to be similar to the others and was at the same distance from the breeding places.

PAPADAKIS (A. M.). **The Biology of *Anopheles superpictus* in Greece.** [*In Greek.*]—*Hellen. Iatr.* [Greek Med.] **10** reprint 9 pp., 2 refs. Salonica, 1936.

From observations over a period of five years in different parts of Greece, the author concludes that the breeding places of *Anopheles superpictus*, Grassi, can be divided into three main types, chiefly according to soil conditions. The first type occurs in torrents and is characterised by having a rocky bottom on which there may or may not be vegetation ; it is small and shallow with very clear water, and is exposed to the sun, although it may be partly shaded for a few hours. The second type occurs in the beds of large rivers and is characterised by having a sandy bottom ; the water, which is clear, may be shallow or rather deep, but is exposed to the sun throughout the day. Almost always there is a thin layer or film of sand or dust floating on the surface. The third type occurs in streams or small torrents, chiefly on hill sides, and is characterised by a thick layer of mud on the bottom ; the water is very shallow and the vegetation, if any, is on the edges. The first type is the most common, but the least favourable to the larvae ; the second type is the most favourable. The observations were verified in several hundred experimental breeding places made next to natural ones.

Observations have also been made on oviposition in nature and in experimental breeding places in the open, and on larval development. The eggs were counted on the surface of the water by means of a hand lens without disturbing the breeding place. In the first and third types of breeding places, the eggs were always found at the edges, particularly where the surface of the water touched the soil. In the second type, they were laid on the layer of dust or sand in the middle of the water surface, rarely at the edges. In the last-named type, eggs were never found if the layer of dust or sand was absent ; moreover, the layer must be thin, for no oviposition took place where it was thick. In the rare cases where the breeding places contained vegetation, the eggs were never deposited on it.

Thus the breeding places of *A. superpictus* appear to be small (in comparison with those of the other Anophelines of Greece), shallow, and exposed to the sun for most of the day, and the water is clear and not cold. In those of the second type, there is also a layer of dust. The fact that this species is prevalent in Greece in the warm months (July–September) would appear to show that it is favoured by sun and abundant daylight, and it is suggested that it chooses small, shallow, sunlit collections of water for breeding because the water in them is uniformly warm. Its eggs, which have no floats, sink easily, and this is thought to be the reason why they are laid either at the edges of the breeding places or on the layers of dust.

Papadakis (A. M.). **The Species of Anopheline Mosquitoes of the Island of Crete : Geographical Distribution and Biology.** [*In Greek.*]—Thesis Univ. Athens, 8vo, 44 pp., 66 refs. Athens, **1934.** [Recd. 1937.]

An account is given of an investigation on the Anophelines of Crete undertaken in 1931–32. The topography of the island is briefly described, and the main rivers and swamps are listed under the four political districts. About 6,000 larvae or adults of Anophelines were collected in 124 localities, the species found being *Anopheles superpictus*, Grassi, *A. maculipennis*, Mg., race *messeae*, Flni., *A. sacharovi*, Favr, *A. claviger*, Mg. (*bifurcatus*, auct.) and *A. algeriensis*, Theo. Their distribution is shown in tables. The second part of the paper deals with their biology, and includes notes on the eggs, larvae and adults, breeding places, oviposition, and the results of precipitin tests and of observations with animal baits.

Of the forms of *A. maculipennis*, only race *messeae* egg type B was found, although on the mainland of Greece egg types B and C are common ; it was not zoophilous, since it fed equally readily on man or animals. Larvae of *A. superpictus* were taken in water of high salinity in association with those of *A. sacharovi* ; a dark variety of the larva of the former species occurred in the western part of the Island near the sea.

Roubaud (E.) & Treillard (M.). **L'engraissement hibernal par l'alimentation sanguine chez l'***Anopheles maculipennis*.—*Bull. Soc. Path. exot.* **30** no. 1 pp. 31–38, 2 figs., 9 refs. Paris, 1937.

It has been suggested that the fat-body in *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel, is derived from the blood ingested, but that in race *messeae*, Flni., it is the result of feeding on sugary food [*R.A.E.*, B **18** 228]. The authors point out that although such a diet is available from spring to autumn, females with a developing fat-body only begin to appear, and then only in small numbers, towards the end of the summer, and there seems to be no reason for a sudden change in their diet. Moreover, although hibernating females (characterised by spontaneous suspension of ovarian activity) may appear during the summer or at the beginning of the autumn, they may also occur at the end of the autumn, in cold weather, when sugary food would be very difficult to obtain. Experiments were therefore undertaken to determine whether *messeae* could develop fat-body when fed on blood only. Engorged females captured in a stable in Camargue on 25th August laid batches of eggs between 10th September and 9th October. From their reproductive activity it was concluded that they were not of the hibernating generation, but it was thought that their progeny might be. To test this, larvae and pupae were reared from the batches of eggs laid on 9th October, and adults were obtained from 24th November. The females, which proved to be hibernating ones, were kept in a small cage over water in a dark unheated room at an average temperature of 14–16°C. [57·2–60·8°F.] and were fed only on blood. On emergence, their abdomens were very flat, they showed normal activity and, from the first, a desire for blood. In spite of the low temperatures, they bit freely and frequently. From the 20th day after emergence, the fat-body could be seen with the naked eye. Four of the females took

a total of 29 blood meals in about a month, or about 7–8 meals each. In one of them, the development of the fat-body was complete by 10th December; the others continued to feed actively until 18th December, after which the feeds became rare and ceased altogether from 28th December, when the development of the fat-body was complete in all of them. Thus the period of complete inactivity in winter shelters when the females are unwilling to feed on blood is the second phase of hibernation and follows a more or less prolonged period during which blood feeds are taken. During this initial phase of hibernation, the behaviour of *messeae* is similar to that of *atroparvus*; in both cases the ingestion of repeated blood meals is not followed by ovulation, and at this time it would seem possible for *messeae* to act as a vector of malaria.

MER (G.). **Variations saisonnières des caractères de** *Anopheles elutus* **en Palestine. II.**—*Bull. Soc. Path. exot.* **30** no. 1 pp. 38–42, 1 graph, 1 ref. Paris, 1937.

Examination of about 500 batches of eggs of *Anopheles sacharovi*, Favr (*elutus*, Edw.) showed that although the temperature at which they develop determines the presence or absence of air floats [*cf.* *R.A.E.*, B **19** 122], it has no effect on the design or colour of the eggs. A study was made in Palestine during 1933–35 of the size of the adult females (based on the length of the thorax) and of the length of their wings at different seasons. The percentage of large mosquitos was highest during the hibernating period from November to March; in 1933 it was 33 in November and 8 in August, in 1934–35 more than 60 from November to March and 8·6 in July–August. Moreover, although the larger mosquitos have the longer wings, the percentage of mosquitos with long wings is higher for a given size during the hibernating season than during the summer. In July–August nearly all the mosquitos have short wings (3·5–4·5 mm.), no matter what their size, whereas those that emerge in November have long wings (4–5·4 mm.). Possibly the appearance of long wings in the hibernating generation is an adaptation for the long pre-hibernation flights [*cf.* **19** 123].

MATHIS (M.). **Élevage en série (six générations) de la mouche verte-cuivrée du Sénégal** *Lucilia cuprina* **Wied.** (*argyrocephala* **Macq.**).—*Bull. Soc. Path. exot.* **30** no. 1 pp. 42–44, 6 refs. Paris, 1937.

At Dakar, Senegal, six successive generations of *Lucilia cuprina*, Wied., were reared at temperatures ranging from 26 to 30°C. [78·8 to 86°F.] in an atmosphere saturated with moisture. The egg, larval and pupal stages lasted 7–11, 70–83 and 90–125 hours, respectively, and the ovaries took 110–164 hours to reach maturity. The adults engorged on sugar-water several times a day, but a daily feed on meat was necessary for the maturation of the gonads [*cf.* *R.A.E.*, B **21** 247]. Pairing takes place some hours before oviposition. The life-cycle occupies about a fortnight. The eggs are laid in compact masses in the crevices in meat; they survived exposure to 5°C. [41°F.] for 48 hours. If no suitable medium is available for oviposition, the eggs may be retained for several days.

FINLAYSON (M. H.). **"Knoppie-Spider" Bite.**—*S. Afr. med. J.* **10** no. 2 pp. 43–45, 4 refs. Cape Town, 25th January 1936. [Recd. May 1937.]

In Cape Province, it has long been known that the bites of certain spiders produce serious symptoms and sometimes death in man. In all the cases in certain areas, the spider concerned was what is known as the "knoppie-spider," and specimens sent from these areas all proved to belong to the genus *Latrodectus.* The three species of this genus known from South Africa are *L. geometricus*, Koch, *L. concinnus*, P. Camb., and *L. indistinctus*, P. Camb., all of which occur commonly in Cape Province. The first two are found in outhouses and in the walls and the crevices in the windows and doors of human habitations, whereas the last is reported as living only in cornfields and on the veldt. The spiders collected were all females, and it is doubtful whether the males are important as a cause of "spider bite." The females are briefly described. A table shows the minimum lethal doses of extracts made from the heads of the several species for mice and in the case of *L. geometricus* and *L. indistinctus* for guineapigs and rabbits also. The lethal dose for mice of extract from *L. indistinctus* is 2–4 times that of cobra venom, and as the extract is obviously in a much cruder state than the relatively pure venom obtained from the fangs of the snake, it is suggested that the spider venom is at least as toxic as that of the Cape cobra [*Naia flava*]. Extracts from the other two spiders are much less toxic. Anti-serum produced by extracts of *L. indistinctus* in rabbits neutralised the venom of all three species of *Latrodectus*, but the anti-serum produced by extracts of *L. geometricus*, although it neutralised the venom of *L. concinnus*, was only partly effective against that of *L. indistinctus.* Owing to the small number of examples of *L. concinnus* received, it was not possible to test the toxicity of its venom to guineapigs or rabbits, or to prepare anti-serum. The symptoms and treatment of spider bite are discussed, and it is suggested that anti-serum should be prepared from *L. indistinctus.*

PAPERS NOTICED BY TITLE ONLY.

BRUMPT (E.). **Facteurs qui agissent sur la transmission des infections par les Arthropodes hématophages** [a general discussion].—*Ann. Parasit. hum. comp.* **15** no. 1 pp. 74–85. Paris, 1st January 1937.

EICHLER (W.). **Parasitologisches im ornithologischen Schrifttum. I.** [A Bibliography of Parasitological Information in Ornithological Literature.]—*Ornith. Mber.* **45** no. 2 pp. 58–63. Berlin, 10th March 1937.

BUXTON (P. A.). **The Numbers of Males and Females in natural Populations of Head-lice** (*Pediculus* [*humanus capitis*, DeG.] : **Anoplura**).—*Proc. R. ent. Soc. Lond.* (A) **12** pt. 1–2 pp. 12–14, 1 ref. London, 15th February 1937.

[REDIKORTZEV] REDIKORZEV (V.). **A Parasite** [*Enderleinellus replicatus*, sp. n.] **of** *Sciuropterus volans* **L.** [in the Tartar Republic and Siberia].—*Parasitology* **29** no. 1 pp. 4–6, 1 fig. Cambridge, 29th January 1937.

BEDFORD (G. A. H.). **Notes on Species of Trichodectidae with Descriptions of new Genera and Species.**—*Onderstepoort J.* **7** no. 1 pp. 33–58, 26 figs. Pretoria, July 1936. [Recd. March 1937.]

Bedford (G. A. H.). **New Species of *Linognathus* and *Polyplax* (Anoplura).**—*Onderstepoort J.* **7** no. 1 pp. 59–65, 7 figs. Pretoria, July 1936. [Recd. March 1937.]

Bedford (G. A. H.). **Description of a new Species of *Hippobosca* [*H. martinaglia*] (Diptera Pupipara).**—*Onderstepoort J.* **7** no. 1 pp. 67–68, 1 fig. Pretoria, July 1936. [Recd. March 1937.]

Bedford (G. A. H.). **A Synoptic Check-List and Host-List of the Ectoparasites found on South African Mammalia, Aves, and Reptilia (Supplement No. 1).**—*Onderstepoort J.* **7** no. 1 pp. 69–110, 23 refs. Pretoria, July 1936. [Recd. March 1937.] [*Cf. R.A.E.*, B **21** 112.]

Jack (R. W.). **Ticks infesting Domestic Animals in S. Rhodesia.**—*Rhod. agric. J.* **33** no. 12 pp. 907–929, 3 pls.; **34** no. 1 pp. 25–37, 13 refs.; also as *Bull. Minist. Agric.* [*S. Rhodesia*] no. 1011, 35 pp., 3 pls., 13 refs. Salisbury, S. Rhodesia, December 1936, January 1937. [Revision: *cf. R.A.E.*, B **16** 226.]

Roy (D. N.). **On the Male Terminalia of *Chrysomyia megacephala* and *C. bezziana*.**—*Indian J. med. Res.* **24** no. 3 pp. 921–922, 2 pls., 2 refs. Calcutta, January 1937.

Root (F. M.) & Hoffman (W. A.). **The North American Species of *Culicoides*** [including 13 new species].—*Amer. J. Hyg.* **25** no. 1 pp. 150–176, 8 pls., 8 refs. Baltimore, Md, January 1937.

Lane (J.). **I.—Notas sobre mosquitos de São Paulo.**—*Rev. Mus. paulista* **20** pp. 429–435. S. Paulo, 20th June 1936. [Recd. April 1937.] [Second note already abstracted: *R.A.E.*, B **25** 29.]

Raynal (J.) & Le Gac (P.). **Phlebotomes dans le nord de Madagascar. *Phlebotomus squamipleuris* Newstead 1912** [with descriptions of both sexes].—*Bull. Soc. Path. exot.* **30** no. 1 pp. 76–90, 12 figs., 1 map, 14 refs. Paris, 1937.

[Korotkikh (G.) & Rafes (P.).] **Коротких (Г.) и Рафес (П.). A Guide to the Literature that has appeared during the Years 1920–1935 in Russian and in other Languages of the USSR on the Use of Aeroplanes in National Economy (chiefly Agriculture and Forestry).** [A bibliography, including 58 papers relating to the use of aeroplanes for applying larvicides against Anophelines.] [*In Russian.*]—La. Cr. 8vo, 83 pp. Moscow, Trud. econ. Sekt. Komit. Econ. i Prava vozd. Flota Osoaviakhima, 1937. Price 1 *rub.* 50 *kop.*

A Bibliography of Nicotine. Part I. Busbey (R. L.) & McIndoo (N. E.). **Chemistry of Nicotine.**—*E 384*, 257 pp. multigraph. **Part II.** McIndoo (N. E.), Roark (R. C.) & Busbey (Mrs. R. L.). **The Insecticidal Uses of Nicotine and Tobacco.**—*E 392*, 628 pp. multigraphed. Washington, D.C., U.S. Dep. Agric., Bur. Ent. 1936. [See *R.A.E.*, A **25** 376.]

Peterson (A.). **A Manual of Entomological Equipment and Methods. Part II.**—Demy 4to, 334 pp., 21 pls. St. Louis, J. S. Swift Co., 1937. Price $4.50 plus postage. [See *R.A.E.*, A **25** 346.]

Feng (L. C.). **The Hibernation Mechanism of Mosquitoes.**—*Arch. Schiffs- u. Tropenhyg.* **41** no. 3 pp. 331–337, 2 figs., 14 refs. Leipzig, March 1937.

Some of the literature on the methods and physiology of hibernation in mosquitos is briefly discussed, and notes are given on observations on six species in and near Peiping, of which four belonged to the genus *Aëdes* and hibernated in the egg stage. *Anopheles lindesayi*, Giles [var. *japonicus*, Yam.], like *A. pattoni*, Chr. [*cf. R.A.E.*, B **20** 6], was found to hibernate in the larval stage under ice. *Culex pipiens* var. *pallens*, Coq., was the only mosquito found hibernating in the adult stage in Peiping. The females were discovered in various places, but especially in unheated, moist, and comparatively dark greenhouses with temperatures varying from 2 to —8°C. [35·6–17·6°F.]. The percentage of individuals with a developed fat-body was highest during December–February and then gradually decreased. Examples collected in winter became quite active at a room temperature of 20°C. [68°F.], but refused to feed on man.

Jurukoff (B.). **Massenhafte Erkrankungen beim Menschen hervorgerufen durch** *Pediculoides ventricosus.* [The Occurrence of Outbreaks of Dermatitis due to *P. ventricosus.*]—*Arch. Schiffs- u. Tropenhyg.* **41** no. 3 pp. 337–341, 2 figs., 10 refs. Leipzig, March 1937.

Dermatitis caused by *Pediculoides ventricosus*, Newp., has occurred epidemically for many years in south-eastern Bulgaria on the Black Sea coast. The cases are most numerous at harvest time, and are common in dwellings where cereals are stored. No direct transmission from man to man has been observed, and complete recovery takes place in 1–2 weeks. Immunity is either not acquired or very short, as people have been affected 2 or 3 times in the same season.

Bruns (A.). **Ueber Rückfallfieber in Abessinien.** [On Relapsing Fever in Abyssinia.]—*Arch. Schiffs- u. Tropenhyg.* **41** no. 3 pp. 343–348, 6 refs. Leipzig, March 1937.

The author briefly reviews existing data on relapsing fever in Abyssinia. He does not think it possible to determine whether lice [*Pediculus humanus*, L.] or ticks are the vectors. *Rhipicephalus sanguineus*, Latr., and *Ornithodorus moubata*, Murr., have been found at Addis Ababa, while *O. savignyi*, Aud., is regarded as the vector in eastern Abyssinia, but he considers that a sudden epidemic in 1929 in Djijiga was due to lice.

Peters (G.). **Durchgasung von Eisenbahnwagen mit Blausäure.** [The Fumigation of Railway Carriages and Waggons with Hydrocyanic Acid Gas.]—*Anz. Schädlingsk.* **13** no. 3 pp. 35–41, 14 figs. Berlin, March 1937.

This is a survey of the methods of producing hydrocyanic acid gas and using it for the fumigation of railway rolling stock employed in various countries.

(1289) Wt. P4/3637 1600 7/37 S.E.R. Ltd. Gp. 353. [r] A

Brody (A. L.). **The Transmission of Fowl-pox.**—*Mem. Cornell agric. Exp. Sta.* no. 195, 37 pp., 3 pls., 20 refs. Ithaca, N.Y., September 1936.

The literature on the transmission of fowl-pox is briefly reviewed and a detailed account is given of experiments carried out during 1933 and 1934 [*cf. R.A.E.*, B **19** 239]. The following is taken from the author's general summary: The disease may be transmitted by direct contact between diseased and healthy birds, the virus spreading not only to the epidermis of the head, but also to the mucous membrane lining the oral and associated cavities. Some evidence was obtained suggesting that blowflies are not concerned in transmission. The infection was transmitted by *Aëdes stimulans*, Wlk., when a female was allowed to complete on a healthy fowl a feed begun about half an hour before on a fowl-pox lesion, and when another that had had an interrupted feed on an infected bird was inoculated two days later into the comb of a healthy bird. *A. aegypti*, L., is capable of transmitting the disease more than once during its life; females that had transmitted it within one hour of their infecting meal were still able to transmit it 39–41 days later. Mosquitos fed on uninfected areas of the combs of diseased birds did not become infective; they transmit the disease most readily when fed on lesions 5–7 days old (this conclusion is based, in part, on work with *A. vexans*, Mg., and *A. aegypti* not reported in the present paper). Negative results were obtained when adults of *Liponyssus sylviarum*, C. & F., were allowed to feed on a healthy bird 4 and 11 days after their last association with a diseased bird, but positive when bodies of these mites were inoculated into a susceptible bird 4 days after. The virus may be found in or on any part of the body of an infected female of *A. aegypti* during the first 3 days of the incubation period. By the fifth day it is localised in or on the proboscis and the head, and can be found in or on them for at least 15 days, even when the mosquito has fed on 3 fowls in the interim. The living virus was present on inanimate objects for at least 42 days, but it could not be demonstrated 61 days after contamination.

Tokunaga (M.) & Esaki (T.). **A new Biting Midge from the Palau Islands, with its Biological Notes.**—*Mushi* **9** no. 1 pp. 55–58, 1 pl., 2 refs. Fukuoka, December 1936.

The female of *Culicoides peliliouensis*, sp. n., is described by Tokunaga from Peliliou Island in the Palau Islands. Notes on its biology are given by Esaki. Although it may occur on many of the islands of Micronesia, it is only on Peliliou that it is abundant and attacks man. The adults appear several days before a new or full moon and are prevalent for a week, or rather more. This would appear to be related to tidal variations, and there is no doubt that the immature stages are passed in the mangrove swamps that surround the Island.

Lamborn (W. A.). **The haematophagous Fly** *Musca sorbens*, **Wied., in Relation to the Transmission of Leprosy.**—*J. trop. Med. Hyg.* **40** no. 4 pp. 37–42, 15 refs. London, 15th February 1937.

After briefly reviewing the literature on the transmission of the bacilli of leprosy [*Bacillus leprae*] by non-biting flies, the author describes his work in Nyasaland on transmission by the haematophagous

non-biting fly, *Musca sorbens*, Wied., much of which has been recorded elsewhere [*R.A.E.*, B **23** 226; **24** 187; **25** 17]. *M. sorbens* may alight on the skin and feed unnoticed, even on regions so sensitive as the face, the slightest break in the surface serving to attract it. It seems to be especially attracted by the odour of the sweat of uncleanly natives and may be obtained in considerable numbers from their bare backs and their clothing, particularly in the early morning and late afternoon during the early part of the wet season. The flies taken in this situation usually make no attempt to feed and most of them are females that contain mature ova. It seems probable that they are awaiting the discharge of faeces, since they utilise only warm fresh material for oviposition. This habit is probably due to the fact that in a country such as Nyasaland, where there is a long dry season during which breeding chiefly occurs, the larvae must make immediate use of their food material if they are to mature before it dries out. A much higher percentage of females that were not gravid was found among those collected while actually feeding on sores. From the proboscis to the rectum, the digestive tract of the fly exhibits the same acid-fast staining reaction as the leprosy bacillus, and it is suggested that this may indicate that it is a favourable habitat for the bacillus [*cf.* **25** 19]. Large numbers of acid-fast coccoid granules, and sometimes minute rods also, may be found in the mucous membrane of the crop of both wild and reared flies some days after they have fed on leprous material. These may not bear any relation to the bacilli, since very similar bodies have been seen in wild flies that may not have had access to leprous material, but it is possible that reproduction of the bacilli may take place in an environment as suitable as the crop wall appears to be, and that developmental forms are set free from time to time in the crop contents, as a result of the rhythmic contractions of that organ that have been observed in the living insect. The granules have not yet been found in the contents of the crops of flies, although minute irregular masses of acid-fast material have been observed.

The theory that haematophagous flies may be responsible for the spread of leprosy is supported by a certain amount of indirect evidence. They are ubiquitous, but are especially numerous in the humid, hot countries in which leprosy is most prevalent. The incidence of leprosy is high in countries where lack of hygiene is responsible for the abundance of flies. The disappearance of leprosy in Europe, which has been attributed to the steadily improving conditions under which the peoples are living, may have been brought about by the control of *M. autumnalis*, DeG., or other haematophagous flies, resulting from the introduction of modern methods of sanitation. The site of the primary leprosy lesions is on parts of the body most liable to attack by flies, such as the legs and feet in barefooted populations. The predilection of *M. sorbens* for the lower extremities is definite and is probably due to the liability of these parts to injury, not only as a result of minor accidents, but also as the result of walking on hot ground in the hot season (in which case the skin becomes cracked) and in liquid mud during the wet season (in which case the skin becomes sodden). Such wounds are particularly likely to become infected owing to the contaminated condition of the soil and so remain open for a long time. If insects are the vectors, then haematophagous Muscids are the most likely ones, owing to their habits of feeding by preference on sores.

O'Connor (F. W.). **Filariasis in Antigua.**—*J. trop. Med. Hyg.* **40** nos. 3–4 pp. 25–31, 42–48, 1 map, 1 graph, 44 refs. London, 1st & 15th February 1937.

After describing the Island of Antigua and reviewing its general and medical history, the author gives a detailed account of his investigation on filariasis due to *Filaria* (*Wuchereria*) *bancrofti*. Its incidence is estimated conservatively at 38·5 per cent.; it is highest in the central clay area, which runs across the Island from the north-west to the south-east, intermediate in the south-western volcanic region, and lowest in the limestone section in the north-east. *Culex fatigans*, Wied., is very abundant in most parts of the Island. In an experiment, fully developed larvae of *F. bancrofti* were found in females of this mosquito that had fed 11–15 days previously on a patient showing 39 microfilariae in 20 cu. mm. blood, and larvae in all stages of development were found in females caught in houses, etc. It is concluded that the parasite can complete its development in *C. fatigans*, certainly at the lower altitudes in most parts of Antigua, at all seasons of the year. The greatest number of fully developed larvae found in a single mosquito following a single blood meal was five, but dissections of wild mosquitos indicate that higher numbers and successive infections may be tolerated. *Filaria* (*Microfilaria*) *ozzardi* was observed in several persons; no study on its transmission was attempted, but in view of Buckley's findings [*cf. R.A.E.*, B **22** 251], it is pointed out that *Culicoides furens*, Poey, is prevalent in some of the coastal areas of the Island.

Starzyk (J.). **Vitalité, toxicité et pouvoir d'immunisation de** *Rickettsia prowazeki* **conservées hors de l'organisme du pou, en milieu liquide et en milieu sec.**—*C. R. Soc. Biol.* **123** no. 36 pp. 1221–1225. Paris, 1936.

Blanc (G.) & Baltazard (M.). **Longue conservation à sec du virus du typhus murin dans les déjections des puces infectées.**—*C. R. Acad. Sci. Fr.* **204** no. 13 pp. 1046–1048, 5 refs. Paris, 1937.

In the first paper, an account is given of experiments on the preservation of *Rickettsia prowazeki* outside the body of the louse [*Pediculus humanus*, L.] with a view to avoiding losses of cultures of the typhus virus in the course of passages and to elucidating the question of its preservation in endemic foci between epidemic periods. The experiments with liquid media showed that the vitality of the virus outside the louse is much higher than was previously thought; it lived for 90 hours at a temperature of 5–7°C. [41–44·6°F.] in normal saline, the least suitable medium, and for 6 days in human serum, which appeared to be the most suitable. The dried media used consisted of starved infected lice and the intestines or excreta of infected lice, kept under various conditions. The more rapidly and thoroughly these media were dried, the longer the virus lived. It survived for a week in dead lice that had been starved and kept under normal conditions, 21 days in those that had been dried over chloride of lime, 35 and 58 days, respectively, in intestines dried under normal pressure or in a vacuum, and as long as 66 days in excreta, which are evidently the best medium. All the cultures retained their toxicity for lice and their immunising power in guineapigs. These findings show that not only are living lice a source of infection, but also dead

lice and, particularly, excreta, which may remain in the clothes of infected persons in the form of fine powder and cause a new outbreak of the disease after a lapse of several months.

In the second paper are given the preliminary results of similar experiments designed to determine the longevity of the virus of murine typhus in the flea, *Xenopsylla cheopis*, Roths. It survived for 7 days in whole fleas and in excreta, both dried rapidly, and for 21 days in excreta kept on blotting paper at laboratory temperature. As an infected flea retains the infection throughout life, the amount of virus set free in nature by the large number of fleas that occur on wild rats must be considerable.

ROBERTS (J. I.). **Plague Conditions in an Urban Area of Kenya (Nairobi Township).**—*J. Hyg.* **36** no. 4 pp. 467–484, 2 graphs, 5 refs. Cambridge, 9th November 1936. **Plague Conditions in a Rural Endemic Area of Kenya (Keruguya District, Kikuyu Province).**—*T.c.* pp. 485–503, 1 fig. **The Carriage of Plague.**—*T.c.* pp. 504–506, 4 refs.

In the first two papers, detailed accounts are given of investigations on plague that have been carried out during recent years in Nairobi township and in the chief rural endemic area of Kenya, respectively. The most important points deduced from the results, including the association of *Xenopsylla cheopis*, Roths., with rats living underground and of *X. brasiliensis*, Bak., with those having their nests in roofs, have already been noticed [*R.A.E.*, B **25** 75].

Outbreaks of plague occur in years when, largely owing to ample rainfall, cereals are abundant ; at such times, large quantities are stored in places accessible to rats, prices are low, and wastage is great. Plague in Nairobi originates and persists in the Indian bazaar area where grain is stored ; the facilities for the breeding of rats are varied, and the flea population is a mixture of *X. cheopis* and *X. brasiliensis*. In the areas where large numbers of Africans reside, no large quantities of grain are stored, and since the rats live underground, the flea population consists almost entirely of *X. cheopis* ; cases of plague appear later and disappear earlier than in the bazaar area, but are numerous during epidemics. In the lines of the King's African Rifles, special attention has been paid to the flooring, and rats are scarce ; the few nests found were in the joints of the roofing timbers, and the flea population consisted chiefly of *X. brasiliensis*. The density of the rat population is higher during epidemics than during quiescent periods, but numbers alone do not appear to be the main factor causing outbreaks of plague among rats. An increase of rats is followed by an increase of fleas. The habits of the two species of fleas explain why, in rural areas, *X. brasiliensis* is found on *Mus* (*Rattus*) *rattus*, which lives in the thatched roofs of native huts, and *X. cheopis* is taken on field rodents, such as *Mastomys coucha* and *Arvicanthis abyssinicus*, which live underground.

In the rural endemic area, plague is associated with an enormous population of *M. rattus*. The flea index is never particularly high and human cases are relatively scarce and sporadic, probably because *X. brasiliensis* on rats living in the thatched roofs of the huts does not come into frequent contact with man [*cf. loc. cit.*]. The fertility of the soil leads to the production of large quantities of cereals and, owing to the wasteful habits of the natives and the primitive methods of

storage, there is an abundance of food available for rats. An interchange of fleas takes place between field rodents and house rats, but not a single field rodent was found naturally infected with plague. A comparison of this area with an endemic area in India [*cf.* **22** 220] showed that both are extremely fertile, large crops of cereals are grown, and the diets of both man and rat are confined to this inadequate source of nourishment. The species of fleas present are different, and in Kenya the mortality in man is lower, possibly owing to the different habits of the rats.

The results of an investigation on the possibility of the carriage of rats and their fleas in maize are given in the third paper. The survey was carried out at Mombasa during February 1936, when large quantities of the Kenya crop were being exported, on the lines of a similar one on cotton seed [**22** 170; **24** 65]. No rats were seen or trapped in 66 trucks of maize examined; the fleas taken from clean white rats after they had been allowed to run about in the trucks comprised 2 males and 2 females of *X. cheopis*, 1 male and 1 female of *Dinopsyllus lypusus*, J. & R., and 1 female of *Ctenophthalmus cabirus*, J. & R. Although maize continues to be unloaded and handled at Mombasa, the town has remained free from plague, and no evidence has been obtained that the transport of maize from endemic centres by railway is a factor in the dissemination of the disease.

STRONG (L. A.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, 1936.**—121 pp. Washington, D.C., U.S. Dep. Agric., 1936.

One section of this report deals with work carried out in 1935–36 on insects affecting man and animals in the United States.

Some of the information on *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) has already been noticed [*R.A.E.*, B **25** 82]. In 1936 this fly migrated northward into Oklahoma from the areas in Texas where it had overwintered, and covered a distance of 50–75 miles in March and April, 125–150 in May, and 150–200 in June. Approximately 4 per cent. of the cottontail rabbits in certain localities in Texas were infested with the larvae, and infestations also occurred on other wild animals. In the south-eastern States, secondary flies, comprising *C. macellaria*, F., and species of *Phormia*, *Lucilia* and *Calliphora* are involved in about 13 per cent. of the cases in domestic animals; heavy infestations by these flies, which may take place 6–10 days after the attack of *C. hominivorax*, may kill the animal quickly. Studies showed that the lethal effect on animals of the larvae of *C. hominivorax* is 4–5 times as great as that of the larvae of *C. macellaria*. Of many substances tested as larvicides, promising results were obtained with a mixture of benzene and carbon tetrachloride containing 10 per cent. ground derris root, soluble pine oil and 5 per cent. nicotine, wormseed oil, and thiodiphenolamine as a dust. The repellent effect of pine-tar oil appears to be increased by the addition of ground derris root, rotenone, or derris resinate. The meadow lark has been found to be the principal host of the immature stages of the Gulf Coast tick [*Amblyomma maculatum*, Koch]. Mixtures of pine-tar oil with resin residue and sulphur applied to the ears of animals have a more lasting repellent action against the tick than other materials tested [*cf.* **25** 82].

C. hominivorax was found to be widely distributed over the entire island of Porto Rico, and to be a serious problem. Twelve successive generations were reared on wounds in guineapigs between 13th October **1935** and September **1936**. Breeding continued (though at a slower rate) throughout the winter, during which the lowest temperature was 56°F. The season of greatest activity was May–July.

Lyperosia irritans, L., was also found to be distributed along the coast of Porto Rico ; it occurred most abundantly on the south coast, where the annual rainfall is 50 inches or less, and is a serious pest of cattle there during the rainy season in April–June. Along the northern and eastern coasts, where the annual rainfall is 50–75 inches or more, it is not considered important except during seasons of unusual drought. More than 75 species of insects were found breeding in cattle dung. The dung beetles, *Ataenius stercorator*, F., *Aphodius lividus*, Ol., and *A. granarius* var. *guadeloupensis*, Fleut. & Sallé, occurred in large numbers at certain seasons, and proved to be indirect enemies of *Lyperosia*, since they tunnelled through the dung and scattered it. Ants are of importance in destroying the larvae of flies and beetles in dung.

A dip containing wettable sulphur (300-mesh), at the rate of 10 lb. to 100 U.S. gals. water, was effective in controlling biting and sucking lice of goats, which caused heavy losses in the United States.

Studies on *Dermacentor variabilis*, Say, the vector of Rocky Mountain spotted fever in the east, showed that this tick is able to survive for over 3 years and indicate the necessity for continuing any control measures against it for a considerable period. A restricted survey of heavily infested areas on Cape Cod and certain islands of Massachusetts failed to reveal the presence of the parasite, *Hunterellus hookeri*, How., which had been liberated several years previously.

Further investigation on the excretions of blowfly maggots has shown that urea also contributes to the healing effects in chronic discharging wounds [*cf.* **24** 102]. Synthetically prepared material has been tested under a wide variety of conditions, such as those obtaining in osteomyelitis, ulcers, gangrene, etc. ; it has contributed to the healing of these conditions, and some wounds that had resisted other treatment for months healed promptly when urea was applied. It appears to be as effective as allantoin and is more readily available. It is reported to be soothing in its action, to reduce pain, and to promote growth of healthy tissue.

YOUNG (M. D.). **Cockroaches as Carriers of *Giardia* Cysts.**—*J. Parasit.* **23** no. 1 pp. 102–103. Baltimore, Md, February 1937.

The experiments described show that, when eaten by the cockroaches, the cysts of *Giardia lamblia* may reach the colon of *Periplaneta americana*, L., *P. brunnea*, Burm., and *Eurycotis floridana*, Wlk., in 2–3 hours. The cysts remained there for as long as 12 days in both species of *Periplaneta*.

TANAKA (J.). **An Observation on Tarsonemidae in Human Urine.** [*In Japanese.*]—*Rec. biol. Soc. Nagoya* **4** pp. 59–61, 1 fig. Nagoya, Japan, December 1936.

A description is given of a Tarsonemid mite of which 14 living examples were found in human urine in Japan ; it closely resembles *Tarsonemus sanguinarius*, Miyake & Scriba [*cf. R.A.E.*, B **14** 48].

Roch (M.). **Les piqûres d'abeilles.**—*Verh. schweiz. naturf. Ges.* **117** pp. 208–223, 30 refs. Aarau, 1936.

This is a brief review of the literature on bee stings and of what is known in regard to immunity and sensibility to the poison, its effects and treatment, and its therapeutic action and application.

Lewis (E. A.). **Sheep Scab: Remedial Measures Reviewed.**—*Bull. ent. Res.* **28** pt. 1 pp.11–28, 1 pl., 21 refs. London, March 1937.

The situations regarding sheep scab in various countries, particularly Great Britain, the Dominions and the United States, are discussed. The types of dips used, their preparation and application and the types of tanks or vats are reviewed, and a number of practical recommendations are made for the care of the sheep before, during and after treatment, and for the care of the dip. Notes are also given on such points as diagnosis, the use of hand dressing, the counting and marking of sheep, the effects of dipping, the question of re-infestation, and the disposal of the dip.

Symes (C. B.) & McMahon (J. P.). **The Food of Tsetse-flies** (*Glossina swynnertoni* **and** *G. palpalis*) **as determined by the Precipitin Test.**—*Bull. ent. Res.* **28** pt. 1 pp. 31–42. London, March 1937.

A detailed account is given of experiments in which the stomach contents of examples of *Glossina swynnertoni*, Aust., from a district of Tanganyika and of *G. palpalis*, R.-D., from Maboko Island, Kenya, were subjected to precipitin tests to determine the food preferences of these flies. The results, although mostly inconclusive, have perhaps narrowed the field of enquiry sufficiently to warrant a continuation of the work along more well-defined lines. Tests with a large number of examples of *G. swynnertoni* against numerous antisera suggested that the main hosts of this fly were one or more Bovids, exhibiting a close blood relationship to ox or buffalo, giraffe and pig. There is evidence that the fly also feeds on monkey or baboon, but not on zebra. The large number of examples of *G. palpalis* from Maboko Island, Kenya, were tested only against crocodile and hippopotamus antisera; the results indicate that these hosts are far less important than was previously supposed and that most of the flies had fed on some other animal.

Nash (T. A. M.). **Climate, the vital Factor in the Ecology of** *Glossina*.—*Bull. ent. Res.* **28** pt. 1 pp. 75–127, 3 pls., 7 figs., 20 refs. London, March 1937.

In the first part of this paper (pp. 76–118), the author deals in detail with the ecology of *Glossina morsitans submorsitans*, Newst., and *G. tachinoides*, Westw., in Northern Nigeria, as determined by numerous observations and experiments carried out since May 1933; some of the results have already been noticed [*R.A.E.*, B **23** 142; **24** 57, 239, 244]. After comparing the climate in the forest and meadow-pan (a term used to describe areas that are luxuriant, swampy meadows in the rains and open expanses of hard, cracking, black cotton clay in the dry season, and which have previously been known as mbuga, vlei, etc.), he discusses

in detail the relation of the various climatic factors to the concentration of these two species, their activity, density and longevity, the duration of their pupal period, and their breeding grounds and breeding activity, and then summarises the data to give a general idea of the type of climate that proves locally to be optimum, adverse or insupportable for their different activities. He next deals with the seasonal distribution of host animals, and with the seasonal variation in the numbers of flies that are hungry and of females that attack man. Finally he describes the vegetation types (residual forest, woodland savannah and meadow-pan) and the distribution of the fly within them. He concludes that the production of a large fly community is greatly hindered by a climate that is usually adverse. *G. m. submorsitans* has probably reached the limit of its distribution in Northern Nigeria; it appears to be unable to colonise large tracts of woodland into which it disperses during the rains, for it is annually driven back to the vicinity of the rivers by the severity of the dry season. There are, consequently, large fly-free areas where cattle can be grazed, but the closeness of contact brought about between man and fly by the concentration of both near permanent water results in a high incidence of sleeping sickness. *G. m. submorsitans* has far greater powers of dispersal than *G. tachinoides* and is better able to withstand adverse climatic conditions, but it is dependent upon game and is therefore confined to the less populated areas. It is also less reliant than *G. tachinoides* on its true habitat and therefore far harder to exterminate, but, at the same time, it is of less economic importance. The results of the investigation indicate that partial clearing might so modify the true habitat that the fly would be unable to survive the most adverse season of the year [*cf.* **23** 143].

In the second part (pp. 118–126), the author compares the ecology of *G. morsitans*, Westw., in East Africa (which he studied in Tanganyika Territory from 1927 to 1932 [*cf.* **21** 197]) with that of *G. m. submorsitans* in West Africa (which he studied in Nigeria from 1933 to 1936). He compares the two climates, suggests climatic limits for the two races, discusses the laws governing their seasonal density, and gives a summary of their ecology. Since identical conditions of saturation deficiency and evaporation are associated with optimum conditions for both races, it is suggested that they are physiologically similar, and that their vital functions are governed by identical laws. This would account for the different nature of the true habitat selected by the West African race, which having failed to adapt its constitution to the climate, has adapted its habits; had it evolved a constitution that preferred a higher degree of evaporation and temperature, the greater frequency of optimum conditions would have enabled it to become as widespread as the East African race.

Potts (W. H.). **The Distribution of Tsetse-flies in Tanganyika Territory.**—*Bull. ent. Res.* **28** pt. 1 pp. 129–148, 1 map, 50 refs. London, March 1937.

Details are given of the distribution of the eight species of *Glossina* that occur in Tanganyika Territory, namely, *G. brevipalpis*, Newst., *G. longipennis*, Corti, *G. fuscipleuris*, Aust., *G. palpalis*, R.-D., *G. morsitans*, Westw., *G. swynnertoni*, Aust., *G. pallidipes*, Aust., and *G. austeni*, Newst. The fly belts, which are shown on a map, are described, and the natural features that affect the distribution of the

fly and the possible extensions that the fly belts may undergo are discussed. Brief notes are given on the habits and habitats of the less known species, *G. longipennis*, *G. fuscipleuris* and *G. austeni*.

JACKSON (C. H. N.). **Some new Methods in the Study of** *Glossina morsitans*.—*Proc. zool. Soc. Lond.* 1936 pt. 4 pp. 811–896, 12 pls., 9 figs., 26 refs. London, 20th January 1937.

A detailed account is given of investigations on *Glossina morsitans*, Westw., carried out in Tanganyika Territory during 1935. The following is taken from the author's summary: The object was to study the concentrations of the fly in really typical country. The vegetation and game animals of the country chosen show that it is typical of very large areas.

The personal factor in assigning flies to hunger stages on the basis of external examination in the field [*cf. R.A.E.*, B **22** 25] is of small importance. The hunger stages so determined bear a relation to the fat content of the flies, Stage II having most fat, and Stage IV, with females and young flies, least fat. Certain criticisms of the feeding-ground theory [*cf.* **18** 240; **19** 62] are shown to be invalid. Hungrier flies really do move through the savannah until an animal is encountered or a feeding ground is reached, and do not normally return to shadier haunts until satisfied. Wet and dry weights of flies are correlated with the hunger stages in the same way as fat, except that Stage I and many old females are relatively heavier. Water is excreted rapidly after the meal, and is reduced in under an hour from above to below normal. "Hunger" seems to be prompted by the need for more fat, ordinarily to replace water lost. The onset of hunger is more rapid in dry than in damp weather, and can be correlated with integrated saturation deficit, at least in that part of the hunger cycle when flies have resumed activity after the meal. Flies are inactive for from 1 to 3 days after feeding; the time varies with the season. Flies with cut proboscides were able to survive in the field up to 10 days after the meal in the rains. Starvation probably occurs about 4 or 5 days after the meal in the height of the dry season. Captive flies lose weight more rapidly than flies released. In captivity, dryness does not affect the amount of fat remaining in the flies after 1 or 2 days, but it does increase the rate of loss of water. The fat cycle is abnormal in captivity; little fat is synthesised from the meal compared with the large amount so produced by wild flies. The death-rate in captivity is high.

A marking method was devised for estimating changes in population that was quite independent of the numbers of flies showing themselves to the catchers [*cf.* **22** 12]. The population of 1·8 square miles was studied. The paints used are not injurious, and bright colours do not cause more flies to be taken by predators. The average error in monthly estimates of male population made in this way was estimated to be only 9·3 per cent. The female population through the year is considerably higher than the male, because (it is believed) the females live longer. Logs are less favoured for larviposition in the country studied than the bases of palms and rot-holes in trees. In nearly 200 marked sites chosen as especially favourable, deposition of larvae was low until leaf-fall set in. Only a small minority of the larvae are ever placed in "favoured" sites. The great majority are scattered among a multitude of small sites considered unworthy of regular

search. The effect is doubtless even more marked in the rains, when the numbers deposited in the chosen sites were very small.

In the dry season, the leafless miombo (*Isoberlinia-Brachystegia* savannah) is almost deserted by the flies, except in some places near its margins. At such times the flies far within the miombo are hungrier than in the concentrations found in some other types outside. Concentrations occur in *Afrormosia angolensis* savannah with numerous thickets on termite mounds, in savannah dominated by *Acacia rovumae* or other trees, and sometimes in the dry season in miombo that comes early into leaf about some drainage valleys. Feeding grounds are found in a variety of types, notably in open alluvial flats with gall-acacias and *Combretum ternifolium*. The feeding grounds are to a large extent disused in the rainy season, but are much visited after the grass fires. Flies are in general heaviest in places of lower visibility or lower light intensity, and are lightest in the most open types. Heavy rain did not kill flies, but probably retarded emergence, partly by lowering the temperature and increasing the pupal period. The population rose from rather before the end of the rains until the grass fires. The rise is attributed to increased emergence, and ceased after the passage of the grass fires, when the death-emigration rate rose. A drop to a low level just after the start of the hot part of the dry season was probably explained by emigration of flies on the departure of game, and a further fall was probably prevented by the increase of animals and the flushing of the trees in certain places. Low activity seemed to be associated through life with low weight of flies at the time of their emergence, but hot dry weather inhibited activity about mid-day. Nutrition, as measured by fat content, became worse in all stages of hunger immediately after the grass fires, and there was also a higher proportion in the catches of flies in the hungrier stages and of females. Host animals were commoner in the dry season. Nutrition, whether measured by mean hunger stage or by mean percentage fat content of samples caught in the field, appeared to improve slightly in the two hottest periods of the year, the middle and late dry seasons. It is suggested that the very high temperatures were killing the hungriest male flies. Probably for the opposite reason, nutrition appeared to become slightly worse with the return of the rains. The population rose greatly when the evaporation rate of the previous month had been above Nash's " optimum zone," so that his conclusions on this subject are not of universal application [*cf.* **21** 197]. The present observations were made in a hotter and drier country than the scene of Nash's studies on *G. morsitans*. It is suggested tentatively that, within wide limits, the absolute density of population may not be fixed by any factors in the environment, which may, perhaps, merely cause rises and falls about any mean level at which the density happens to be. This is partly because competition for food does not occur among tsetse flies at ordinary densities, and it is doubtful whether pressure of numbers in the ordinary sense exists at all. There is no evidence that density is fixed by natural enemies, though these must, of course, affect it. Without some such suggestion as that advanced, it is difficult to understand why, in the absence of competition for food, tsetses should be permanently more abundant in some places than in others. The matter is bound up with the question of possible social habits ; its practical importance demands investigation if the concentrations of *G. morsitans* are to be attacked with any certainty of success.

BONNE (C.) & others. **Over de Crithidiën van** *Triatoma rubrofasciata* **de Geer.**—*Geneesk. Tijdschr. Ned. Ind.* **76** no. 29 pp. 1824–1826. Batavia, 21st July 1936. *T.c.* no. 30 pp. 1908–1910, 28th July 1936. (With a Summary in English.) *T.c.* no. 38 pp. 2391–2393, 22nd September 1936. *T.c.* no. 39 pp. 2483–2486, 29th September 1936. *T.c.* no. 51, pp. 3390–3393, 22nd December 1936. *Op. cit.* **77** no. 2 p. 88, 12th January 1937.

This series of six papers deals with further studies on the crithidia of *Triatoma rubrofasciata*, DeG., in Java, and the trypanosomes that develop from them in mice [*cf.* *R.A.E.*, B **24** 89, etc.]. In the first are described attempts, by means of xenodiagnosis [*loc. cit.*] and examination of blood smears, to demonstrate infection in children from houses where nearly all the bugs were infested and also in a number of examples of *Macacus cynomolgus*. In all cases the results were negative. Human blood was apparently not a suitable food for the bugs, as those fed on man developed more slowly than those given mouse blood. In the second paper, which is by F. H. Meijer, an account is given of precipitin tests, which showed that examples of *T. rubrofasciata* collected in houses and sheep stalls had fed on rats, but not on other animals or man.

In the third and fourth papers, the morphology of the trypanosomes that develop in mice is described and they are identified as *Trypanosoma conorhini*. In an experiment in which uninfected larvae of *Triatoma* were fed on rats from houses, some of those fed on one rat became infected with crithidia. These crithidia were inoculated into mice, and the trypanosomes that appeared in the latter agreed fully with *Trypanosoma conorhini*. In the fifth paper, which is by W. Mooy, are recorded experiments in which mice and rats became infected with *Trypanosoma conorhini* by eating infected Triatomids. In the final paper, it is stated that attempts to infect *Cimex* by causing it to suck the blood of a mouse infected with *Trypanosoma conorhini* gave negative results, whereas *Triatoma rubrofasciata* acquired the infection from the same mouse.

MULDER (J. G. A.). **De malariabestrijding te Tjalang, Westkust van Atjeh.** [Malaria Control at Tjalang, West Coast of Atjeh.]—*Geneesk. Tijdschr. Ned.-Ind.* **76** no. 30 pp. 1864–1889, 3 pls., 1 map, 5 graphs. Batavia, 28th July 1936. [Recd. 1937.]

Up to 1934, malaria was endemic at Tjalang, a military post on a peninsula 3–9 ft. above sea-level on the west coast of Atjeh, Sumatra. The area includes small lagoons, marshes and reclaimed marshland, and *Anopheles sundaicus*, Rdnw. (*ludlowi* auct.), which is the local vector, bred chiefly in some of the lagoons. The prevalence of malaria from year to year was inversely correlated with the amount of rainfall. The lagoons, which receive water from neighbouring hills, are favourable for the breeding of *A. sundaicus* when the channels that connect them with the sea become blocked with sand. This is particularly liable to occur in June–August, when the sea is usually rough. Most of the rain falls in September–November, and, if it is heavy enough, the water from the hills breaks through the sand barriers and the lagoons discharge into the sea. In 1934, measures, which are described in detail, were taken to ensure a good outflow from the lagoons, and their effect was increased by heavy rains. Some of the lagoons were reduced

to narrow channels and ran dry during the dry weather. The incidence of malaria decreased rapidly, and the post remained almost free from the disease until the end of March 1936. In April and May there was a slight epidemic and adults of *A. sundaicus* were captured, though collections of larvae showed that they had not come from the former breeding places. The epidemic is ascribed to a remarkable spell of dry weather in January and February, which caused the mouths of many rivers to remain closed and the marsh water to fall below sea-level. Heavy rain should end such an epidemic.

THIERFELDER (M. U.). **Enkele opmerkingen over het ontstaan der lepra.** [Some Observations on the Origin of Leprosy.]—*Geneesk. Tijdschr. Ned.-Ind.* **76** no. 34 pp. 2133–2137. Batavia, 25th August 1936. (With a Summary in English.) [Recd. 1937.]

As a result of observations in Java, the author suggests that leprosy is transmitted by ectoparasites, possibly the clothes louse [*Pediculus humanus*, L.], which was found only in villages where the disease was gradually spreading. Lice, fleas and *Aëdes aegypti*, L., were fed on lepers, and on dissection nearly all proved negative, but acid-fast bacilli were found in some of the lice soon after they had fed. In lice that fed 5–6 days previously, the bacilli were not acid-fast, but could be stained with carbol-thionin. According to the literature, negative results have been obtained in attempts to infect man with acid-fast leprosy bacilli, and the author suggests that the bacillus can infect man only when not in an acid-fast stage.

TILLEMA (S.). **Enkele gevallen van een steek door een Dajaksche vlieg** (*Chrysops fixissima*, **pikat).** [Some Cases of Bites by *C. fixissima*.]—*Geneesk. Tijdschr. Ned.-Ind.* **76** no. 50 pp. 3330–3331. Batavia, 15th December 1936.

A brief description is given of the symptoms and treatment of bites of *Chrysops fixissima*, Wlk., in Borneo.

SYMES (C. B.) & VANE (R. T.). **The Eradication of** *G. palpalis* **from River Areas by the " Block " Method.**—8vo 61 pp., 8 pls., 3 loose maps, 5 charts (2 fldg), 5 refs. Nairobi, 1937.

A detailed account is given of an experiment that has been in progress since 1933 in the South Kavirondo District of Nyanza Province of Kenya on the control of *Glossina palpalis*, R.-D., by trapping and hand-catching in blocks of bush isolated by clearings along the Kuja River and its tributaries. Some of the information has been noticed from an earlier report [*R.A.E.*, B **24** 87]. Brief notes are given on the topography, climate and fauna of the locality and on the incidence of sleeping sickness and the habits of the population. The clearings, which are described, were made at established traffic crossings to which the natives usually come for water, for bathing and for watering cattle, so that the contact between man and fly was reduced when the blocks of bush were isolated. The work of eliminating the fly is discussed. Paths were cut for fly boys through the bush along or near river banks in all blocks and control areas. Trapping, hand-catching and collection of pupae were the only methods used, and collection of

pupae was given up as uneconomical, because breeding places were found to be very scattered. The four blocks of bush isolated contained about 12½ miles of river; on 11 miles the fly has been reduced to negligible numbers, and on the other 1½ miles its density has decreased by about 93 per cent. Settlement is proceeding on some six square miles of land freed from fly. The fly has been eliminated over a greater area, but this part of the land is not being opened for settlement until an adjacent block has also been freed. The rivers are being patrolled to prevent reinfestation. Traps, which are effective only when the fly density is high [*cf. loc. cit.*], gave the best results when situated on promontories, probably because this made them conspicuous to the fly. Hand-catching appears to be an economic method of attack in isolated blocks; cloth screens [*cf.* **21** 114] proved to be of little value as an aid to hand-catching. Clearings up to 1,050 yards in length were not completely effective barriers against *G. palpalis*. There are indications that reproduction is accelerated during the period March–July. The costs of each step in the work are given. The approximate cost of eliminating *G. palpalis* in a mile of riverine bush was about £40, whereas the cost of clearing a mile of such bush has been about £250. Moreover, the method preserves useful bush and timber and prevents desiccation and erosion.

PARROT (L.). **Note sur les Phlébotomes.—XXIII. Présence dans l'Aurès (Algérie) de *Phlebotomus sergenti* var. *alexandri* Sinton.**—*Arch. Inst. Pasteur Algérie* **14** no. 4 pp. 428–431, 2 figs., 8 refs. Algiers, 1936.

Notes are given on the characters of the female of *Phlebotomus sergenti* var. *alexandri*, Sinton, examples of which have recently been received from Algeria [*cf. R.A.E.*, B **24** 312], and this variety is raised to specific rank.

SENEVET (G.). **Notes sur les moustiques.—IV. Quelques culicides de la région de l'Aurès (Algérie).**—*Arch. Inst. Pasteur Algérie* **14** no. 4 pp. 432–448, 3 figs., 25 refs. Algiers, 1936.

CLASTRIER (J.). **Contribution à l'étude de la pathologie de l'Aurès (Algérie).**—*T.c.* pp. 449–557, 18 pls., 17 figs., 21 refs.

In the first paper, notes are given on the mosquitos collected from a locality in a valley in the Aurès Massif; they include two Anophelines, *Anopheles hispaniola*, Theo., and *A. marteri*, Sen. & Prun. A list of the mosquitos that have been recorded from Algeria is appended.

In the second chapter of the second paper, an account is given of the diseases observed among the native population in the same valley. They include relapsing fever, oriental sore [*cf. R.A.E.*, B **24** 312], and malaria, which is one of the most important. The river runs in a deep canyon cut in the floor of the valley. *Anopheles hispaniola* breeds in pools left when the flooded river subsides, and in small collections of water on the floor of the valley, but the latter are usually too far from the canyon where the villages are situated to be of importance in connection with the transmission of malaria. It is only in years when rain is scarce that *A. hispaniola* occurs in large numbers, for when the rainfall is abundant, the frequent floods in the river bed wash away the larvae and prevent the formation of suitable pools. *A. marteri* bred in reservoirs containing water that seeps from the side of the

canyon, but it does not appear to be a vector of malaria, since there was no outbreak of the disease in 1935, when breeding in the river bed had been prevented by floods but larvae of *A. marteri* were present in the reservoirs.

In the course of the third chapter, a list is given of the Arthropods of the region; these include lice [*Pediculus humanus*, L.] and fleas, which are extremely abundant, mosquitos, *Phlebotomus* spp. [*cf. loc. cit.*], and the ticks, *Rhipicephalus fulvus*, Neum., *R. sanguineus*, Latr., and *Argas persicus*, Oken.

Giaquinto Mira (M.). **Contributo agli studi sul problema della trasmissione della onchocercosi nel Guatemala.** [A Contribution to Studies on the Problem of Transmission of Onchocercosis in Guatemala.]—*Ann. Igiene* **47** no. 3 pp.109–125, 3 maps, 12 refs. Rome, March 1937.

The literature on the transmission of onchocercosis by Simuliids in Mexico and Guatemala is briefly reviewed [*R.A.E.*, B **20** 113; **23** 172, etc.]. In 1933–35, the author investigated the geographical distribution in Guatemala of *Simulium metallicum*, Bellardi (*avidum*, Hoffm.), *S. ochraceum*, Wlk., and *S. callidum*, D. & S. (*mooseri*, Dampf), the three species in which the developmental stages of *Onchocerca caecutiens* have been found [**23** 172], and recorded the captures made after the gnats had bitten man or animals used as bait in various localities. *S. ochraceum* showed a marked preference for feeding on man, it is common, if not always predominant, in the zone where onchocercosis is endemic, and its distribution coincides with that of this disease. While both *S. metallicum* and *S. callidum* attacked man in nature, they had a definite preference for animals and occurred in districts in which persons harbouring *O. caecutiens* are found, but in which onchocercosis is not endemic.

Strong (R. P.). **Onchocerciasis in Central America and Africa.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 5 pp. 487–499, 6 refs. London, 4th March 1937.

In the course of this discussion of onchocercosis of man in Central America [*cf. R.A.E.*, B **23** 172] and Africa, an account is given of investigations in the region of Lusambo, undertaken as a result of Hissette's report [**21** 85] that in that part of the Belgian Congo ocular disturbances were connected with infestation by *Onchocerca volvulus*. This manifestation had not previously been observed in Africa [*cf.* **23** 134], but is well known in Central America, which is the reason why the parasite concerned was named *O. caecutiens*. About 95 per cent. of the population in the Lusambo region was found to be infected and showed demonstrable nodules, and there was a high percentage of persons suffering from failing vision and blindness. Experience in Africa and Guatemala seems to indicate that disturbances of the eyes are most likely to occur when the nodules or tumours are situated on the head or shoulders. In both continents, it has been shown that the prevalence and spread of the disease are especially dependent on geographical and climatic conditions and on a flora favourable to the Simuliid vectors. The agricultural pursuits and habits of the inhabitants are also of importance in connection with the prevalence and dissemination of the disease, since they determine the closeness

of contact between man and fly. In the region of Lusambo, the terrain is characterised by ridges and hills, separated by volcanic crevices and rather narrow valleys with steep sides and running streams at the bottom, and by areas of dense, tropical vegetation or forest [*cf.* **21** 85]. Species of *Simulium* breed extensively in the streams, and the natives are brought into contact with them in the course of cultivating cotton and cassava and collecting piassava palm, and while bathing or fetching water. The frequent travelling of natives from Lusambo to other villages, often at a considerable distance, aids in the spread of infection. *S. damnosum*, Theo., and *S. neavei*, Roub., are concerned in transmission, and both are frequently found breeding at altitudes below 1,000 ft.; the disease is prevalent at or below 1,500 ft. In Guatemala, not more than 5 per cent. of the wild flies in endemic districts were infected and the human infection rate in the different villages varied between 40 and 66 per cent.; whereas in a village in the Lusambo region, about 33 per cent. of the flies and almost all persons residing there were infected.

With a view to discovering whether a mammalian host other than man could be found for *O. volvulus*, studies were made on small mammals, various species of antelope, wart-hog, buffalo and hippopotamus. A species of *Onchocerca*, apparently morphologically identical with *O. volvulus*, was found in eland.

Worth (H. N.). **The Control of Anopheline Breeding in River Beds.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 5 pp. 521–530, 4 pls., 6 refs. London, 4th March 1937.

An account is given of experiments carried out at Badulla, Ceylon, to discover practical methods for treating river beds to eliminate the breeding places of *Anopheles culicifacies*, Giles, the chief, if not the only, vector of malaria in the Island [*cf. R.A.E.*, B **24** 92, 93]. In 1934–35, the pools in rocky sections of the river were drained or filled and sealed. In many cases, effective drainage was obtained by merely loosening the tightly wedged boulders with steel bars; in a few, blasting was necessary. Where economical drainage was impossible, the cavities in rocks or pockets between very large boulders were tightly packed with small boulders, shingle and gravel up to water level, and finally sealed with 1½ inch cement grout finished with a slight slope towards the stream. The cutting of chases was occasionally found useful and economical in draining long, shallow, permanent pools. Cold asphalt emulsions, which are cheaper than cement grout, gave fairly satisfactory results in sealing shallow pools in situations where they are not subjected to heavy scouring. After the monsoon rains of 1935, the experimental section was inspected and the defective asphalt seals made good. The results were extremely satisfactory, and the river is now entirely free from shallows and isolated pools at all its stages and under various conditions of rainfall. In sections with a sandy bottom, the low-water channels and bed levels were first determined, and silting was then encouraged and scouring reduced by means of concrete blocks cast on the spot from metal moulds in the shape of a regular tetrahedron with 12-inch sides, and placed by hand at suitable spots. Examination after the monsoon rains showed that they were very effective both for holding down the sand and for forming closures to subsidiary bays and channels. They were very useful for experimental work; owing to their durability, they could

be used many times without further expense except for handling. Groins and spur dikes made of tubes of wire-fencing filled with boulders were laid at selected intervals at an angle of approximately 90° to the dry-weather channel. They offered rather too much resistance in times of flood and caused the formation of a certain number of pools on their upstream side, but the sand was satisfactorily retained between them and they appeared to be particularly suitable for withstanding strong currents and maintaining the course of the channel at sharp bends. In 1936, a number of tests were carried out on the control of dry-weather channels and the equalisation of sand deposit in river beds by means of low bamboo stakes driven into the river bed to form fences on both sides of the dry-weather channel and spur dikes at intervals from the bank to the fences. At times of flooding, these permeable barriers hold up the floating débris, check the velocity of the water, and bring about the deposition of silt, which gradually forms banks and raises the level of the surrounding country. Scouring in the main channels was successfully prevented by check dams constructed by placing three rows of bamboo stakes across the river and filling the intervening spaces with loose boulders. It is concluded that Anopheline breeding places in river beds can be considerably reduced and in some cases entirely eradicated by the methods described. The importance of first clearing away temporary obstructions, such as logs and trees, is emphasised, since, in many cases, particularly in tributaries, the formation of pools is due to this cause alone and no further measures are necessary.

RUIZ (C.) & DE LANDAZURI (O.). **Fièvre boutonneuse in Spain and its experimental Transmission by Ticks. A preliminary Note.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 5 pp. 539–540, 1 pl., 1 map. London, 4th March 1937.

During recent years, 80 cases of Marseilles fever, which is transmitted by *Rhipicephalus sanguineus*, Latr., have been observed in the Hospital for Infectious Diseases, Madrid. A study of their origin showed that the two principal foci of infection were the two poorest working-class suburbs. Ticks (*R. sanguineus*) collected in the houses where cases had occurred were crushed and inoculated into 9 guineapigs, and 7 showed a rise in temperature. Ticks bred in the laboratory gave rise to eggs and larvae in which small quantities of micro-organisms of the rickettsia-type were recognisable. An eruption typical of the disease resulted from the inoculation of a mental patient with an extract of ticks.

PURCELL (F. M.). **A Dengue-like Fever in the Gold Coast.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 5 pp. 541–544, 1 ref. London, 4th March 1937.

A description is given of a disease resembling dengue fever that is prevalent in the Gold Coast. It seems to be confined to the forest regions in the rainy belt, and does not occur in the coastal towns or in widely cleared areas such as Kumasi. The two rainy seasons in the forest belt are in March–July and September–November. The incidence appears to be highest during the first rains, but cases have also been observed in September. The vector is not known, but *Culicoides grahami*, Aust., which is an avid feeder, is very prevalent in the endemic areas ; *Aëdes aegypti*, L., is widely distributed, but occurs in the coastal towns where the fever is not known.

Treillard (M.). **Anophèles de Camargue.**—*Bull. Soc. Path. exot.* **30** no. 2 pp. 136–139, 5 refs. Paris, 1937.

A brief survey carried out in 1936 showed that the races of *Anopheles maculipennis*, Mg., that occur in Camargue [*cf. R.A.E.*, B **15** 137] are *messeae*, Flni., *atroparvus*, van Thiel, and *cambournaci*, Roub. & Treill.

Roubaud (E.). **Stomoxydes d'Afrique.**—*Bull. Soc. Path. exot.* **30** no. 2 pp. 140–144, 2 figs., 4 refs. Paris, 1937.

Stomoxys xanthomelas, sp. n., is described from two females from the Belgian Congo and *S. sexvittata* var. *halophila* n., from both sexes from the neighbourhood of Dakar, Senegal. The eggs of the latter are laid late in the afternoon in damp sand at the edge of lagoon-like streams or saline pools a short distance from the sea. Analyses of samples of water from two of the pools showed the salinity to be 25·530 and 64·900 parts salts per mille. The adults attack man readily, as well as animals.

Le Gac (P.). **Rôle des " Pélopées " dans la création de gîtes à " phlébotomes " à l'intérieur des habitations à Madagascar.**—*Bull. Soc. Path. exot.* **30** no. 2 pp. 144–145, 1 fig. Paris, 1937.

Adults of *Phlebotomus squamipleuris*, Newst., have been observed to emerge from the nests of a Sphegid wasp inside dwellings in Madagascar, and to return to them after feeding. It seems probable that eggs and larvae of the sandfly are brought in on the mud of which the nest is built.

van Thiel (P.) & Sautet (J.). **Etude concernant l'existence des biotypes anthropophiles de l'***Anopheles maculipennis*.—*Bull. Soc. Path. exot.* **30** no. 2 pp. 186–193, 7 refs. Paris, 1937.

In August 1936, a study was made of the feeding habits of *Anopheles maculipennis*, Mg., race *labranchiae*, Flni., and *A. sacharovi*, Favr (*elutus*, Edw.) at Bastia, Corsica, where the Anopheline population consists almost entirely of these two " biotypes." The apparatus was that used in previous experiments in which the mosquitos are confined in a cage communicating with a box containing a man and one containing a pig [*R.A.E.*, B **24** 225]. The technique of the experiments is described and the results are shown in a table. The following conclusions are taken from the author's summary: In a confined space, man does not attract these mosquitos to an extent that prevents all or nearly all of them from entering the pig box. Thus the term anthropophilous as applied to these biotypes can only be interpreted as a tendency to bite man or animal indiscriminately. In a confined space, they sometimes behave as though they were zoophilous. High relative humidity appears to determine the direction of flight, except in cases where the temperature is very high (probably above 28°C. [82·4°F.]). Far fewer mosquitos engorged in these experiments than in the previous ones [*loc. cit.*]; this is believed to be explained by the entophily [**24** 46] of *A. maculipennis* race *atroparvus*, van Thiel, and the more exophilous behaviour of the other two biotypes. This suggests that the apparatus used to study the former in Holland is not suitable for the study of the latter in the Mediterranean climate.

VAN THIEL (P.). **Quelles sont les excitations incitant l'*Anopheles maculipennis atroparvus* à visiter et à piquer l'homme ou le bétail ?**—*Bull. Soc. Path. exot.* **30** no. 1 pp. 193–203, 6 refs. Paris, 1937.

In 1936, experiments to determine the stimuli that cause *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel, to suck blood were continued [*cf. R.A.E.*, B **24** 224]; the results are discussed in conjunction with those already obtained. The stimulus exercised by pig blood is not so great as was supposed and in two experiments was equalled by that of distilled and red water, respectively. The stimulus exercised by human blood was confirmed, although blood that was definitely attractive in some experiments was not more attractive than water in others. Thus it would appear that race *atroparvus* is sometimes zoophilous and sometimes anthropophilous, depending on the samples of animal or human blood used.

It was observed that a certain number of mosquitos moved to a part of the cage that had been breathed on and began to bite the stuff. Experiments were carried out with both *atroparvus* and *Aëdes aegypti*, L., to determine whether this was due to the warm damp air or to the carbonic acid exhaled. The apparatus used is described. The mosquitos did not react when unwarmed air was introduced into the cage, but were attracted by warm moist air and by carbon dioxide, particularly when it had been passed through warm water. Where carbon dioxide is concerned, temperature is not considered the fundamental stimulating factor. It is concluded that carbon dioxide increased the attraction exercised by warm moist air, and it would therefore appear that mosquitos are attracted not only by the warmth and moisture of the skin but also by the carbonic acid given off by it. Mosquitos are more attracted by perspiring persons than others. It is possible that this is due to an increase in the heat radiated from the skin in spite of the evaporation of perspiration, but, in any case, it is augmented and perhaps caused by the greater amount of carbonic acid given off under these conditions. It is also possible that the smell of blood emanates through the skin and is present in the breath, and that this reinforces the other stimulating factors. It is concluded that heat, moisture and carbonic acid, probably in combination, attract mosquitos, and that olfactory stimuli are not necessary (at least in a confined space) to enable the mosquito to find its host. Since it is unlikely that differences in heat and humidity inside and outside houses and stables are discernible at a distance, it would seem likely that Rudolf's conclusion that carbonic acid is the primary attractive agent is correct [*cf.* **10** 190], the emanation of this gas enabling mosquitos to sense man at a distance. Differences in the attractive power of two organisms may be due to differences in the intensities of the stimuli described.

GALLIARD (H.). **A propos de l'attraction des microfilaires de Bancroft par la sécrètion salivaire des moustiques.**—*Bull. Soc. méd. chir. Indochine* **14** no. 7 pp. 977–980. Hanoi, 1936.

In the course of investigations on the transmission of *Filaria* (*Wuchereria*) *bancrofti* in Tonkin, a study was made to determine whether the attraction exercised by the salivary secretions of mosquitos on the microfilariae [*cf. R.A.E.*, B **20** 169] is constant and whether it is a specific characteristic of efficient vectors. The mosquitos used

were *Culex fatigans*, Wied., *Anopheles hyrcanus*, Pall., *Mansonia indiana*, Edw., *Armigeres obturbans*, Wlk., *Aëdes albopictus*, Skuse, and *A. aegypti*, L. (*argenteus*, Poir). The results showed that, although the attraction certainly exists, it is not so great as has been believed. It could not be observed in cases where the number of microfilariae in the peripheral blood was low. It varied in different species and in different individuals belonging to the same species. It would appear that the intensity of the attraction depends on the length of time the mosquito takes to engorge rather than on the amount of blood ingested. Although the species that are the most efficient vectors of filariasis (*C. fatigans* and *A. hyrcanus*) are the ones that appear to exercise the greatest attraction, the difference between them and the other species is not sufficiently great to account for their efficiency.

DE BEZERRA (A.). **Habitos dos anophelineos do Brasil.** [Habits of the Anophelines of Brazil.]—*Folha med.* **17** no. 7 pp. 125–128. Rio de Janeiro, 5th March 1936. [Recd. June 1937.]

A general account of the biology of Anophelines is given, with a brief survey of a few characteristic points regarding the species found in Brazil.

Anopheles (*Nyssorhynchus*) *albitarsis*, Arrib., *A. albitarsis* var. *braziliensis*, Chagas, *A.* (*N.*) *tarsimaculatus*, Goeldi, *A. tarsimaculatus* var. *oswaldoi*, Peryassú, and *A.* (*N.*) *argyritarsis*, R.-D., usually oviposit in water with the surface half shaded and half in sunshine. On many rivers, *A. argyritarsis* infests boats at anchor. *A. albitarsis* and *A. tarsimaculatus* feed on both man and animals, but the former, which occurs throughout Brazil and is domestic in some localities, has a marked preference for human blood. *A. tarsimaculatus* and *A. peryassui*, D. & K., have been observed in the open in daylight. *A.* (*N.*) *strodei*, Root, and *A.* (*N.*) *lutzi*, Cruz, occur inland and not on the coast; the latter species prefers swamps. *A.* (*N.*) *bellator* var. *cruzi*, D. & K., is found in the hills at altitudes up to over 1,600 ft., is preferably bromelicolous and is thought to carry malaria, though it has not been proved to do so in the laboratory. *A.* (*N.*) *parvus*, Chagas, *A.* (*N.*) *nigritarsis*, Chagas, and *A.* (*N.*) *gilesi*, Neiva, occur inland only and in small numbers and are not considered to be vectors of malaria. *A.* (*N.*) *darlingi*, Root, has been found naturally infected and has been taken in dwellings, so that it is regarded as a vector. *A.* (*N.*) *rondoni*, Neiva & Pinto, also has domestic habits and is common on river craft. It has been infected experimentally. *A.* (*N.*) *bachmanni*, Petrocchi, is thought to be a vector, especially of quartan malaria [*Plasmodium malariae*].

A. maculipes, Theo., *A. intermedius*, Chagas, and *A. fluminensis*, Root, oviposit in shaded water with dense vertical and horizontal vegetation and feed on large domestic animals. *A. mediopunctatus*, Theo., and *A.* (*Stethomyia*) *nimbus*, Theo., feed exclusively on wild animals, as does *Chagasia fajardoi*, Lutz, though the latter has been fed on man in the laboratory. *A. eiseni*, Coq., is widely distributed in America. Only one example of *A. mattogrossensis*, Lutz. & Neiva, has been taken, and little is known of *A.* (*Nyssorrhynchus*) *cuyabensis*, Neiva & Pinto, *A.* (*N.*) *triannulatus*, Neiva & Pinto, or *A. minor*, Costa Lima. *A. gambiae*, Giles (*costalis*, auct.) has recently become established in Brazil [*cf. R.A.E.*, B **20** 171].

Symposium : Insects affecting Man.—*J. econ. Ent.* **30** no. 1 pp. 9–71. Menasha, Wis., February 1937.

In a paper entitled Mosquitoes and their Control (pp. 10–17, 4 refs.), T. J. Headlee deals with the species of mosquitos that cause annoyance to man in the United States, particularly those that breed in salt marshes. He attempts to assess their economic importance in terms of differences in increase of taxable values of land in localities where they are of no importance, where they still exist in large numbers, and where control measures have been carried out, and concludes that the increase in areas freed from them corresponds to that in areas in which they have always been relatively scarce, whereas the rate of increase in uncontrolled areas is low. The conditions necessary for the breeding of large numbers of mosquitos, the means by which they are distributed, and the methods of control for both adults and larvae are briefly discussed, and it is pointed out that, in order to deal with them satisfactorily, it is necessary to have an adequate knowledge of the local mosquito fauna and to form an organisation to carry out the practical work. The importance of being able to measure the results of control measures is emphasised and the value of mosquito traps in this connection is mentioned.

In Mosquitoes and Malaria (pp. 20–26), L. L. Williams gives notes on the habits of Anopheline mosquitos concerned in the transmission of malaria in different parts of the world, particularly those of *Anopheles quadrimaculatus*, Say, the only important vector in the south-eastern part of the United States where malaria is prevalent, and of the other species of Anophelines that occur there. The history of the introduction of malaria into different parts of North America, and its subsequent regression is reviewed, as well as the history of the growth of organisations for its control and their effect on the incidence of the disease.

In Myiasis of Man (pp. 29–39, 17 refs.), W. E. Dove discusses the different types of infestation of man by Dipterous larvae, and gives brief records from the literature of numerous cases (chiefly from the United States), showing the species of flies concerned. It would appear that more than 100 cases of myiasis due to *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) had occurred in 1935, whereas only 8 cases were reported in 1936, and it is believed that the reduction was due to the educational control programme, which resulted in a reduction of the numbers of the fly infesting cattle. Figures are given showing the increase in the number of infestations in cattle in the south-eastern States in 1933 and 1934 and the subsequent decline following the adoption of control measures [*cf. R.A.E.*, B **25** 82].

In Some Therapeutic Uses of Insects and their Products (pp. 41–48), W. Robinson describes the use of mosquitos for inducing malaria in cases of paresis, the treatment of arthritis with bee venom, the application of extracts from certain Meloid beetles as counter-irritants, and, at greater length, the use of blowfly larvae or extracts from them in the treatment of infected wounds.

A paper entitled Ticks of the United States in relation to Disease in Man (pp. 51–69, 2 pp. refs.), by R. R. Parker, C. B. Philip, G. E. Davis and R. A. Cooley, is divided into three sections, the first containing information on 13 species of ticks that are actual or potential vectors of diseases of man in the United States, the second information on Rocky Mountain spotted fever, tularaemia, tick paralysis, relapsing

fever and Marseilles fever, which has not yet been recorded in the United States, and on their vectors, and the third information on other conditions that are known or have been reported to be associated with the bites of ticks.

MacCreary (D.) & Pearson (A. M.). **Preliminary Toxicity Tests with Horseflies.**—*J. econ. Ent.* **30** no. 1 p. 214. Menasha, Wis., February 1937.

In preliminary tests against *Tabanus* spp., carried out in Delaware in 1935 with a spray consisting of 5 per cent. of an extract of pyrethrum (containing the equivalent of 20 lb. flowers to 1 U.S. gal.) and 95 per cent. of a base oil (viscosity 40–45 seconds), 99·3 per cent. of the flies were on the floor in 10 minutes [*cf. R.A.E.*, B **24** 304] and all were dead in 12 hours. Only 8·9 per cent. of the unsprayed flies were dead in 24 hours, and in previous tests with the same spray against house-flies [*Musca domestica*, L.], 75 per cent. were down in 10 minutes but only 12·3 per cent. were dead in 24 hours. The Tabanids, of which 90·2 per cent. were *Tabanus nigrovittatus*, Macq., had had their wings clipped to prevent them injuring themselves in their efforts to escape from the spray chamber.

Schwardt (H. H.). **Horseflies of Arkansas.**—*Bull. Ark. agric. Exp. Sta.* no. 332, 66 pp., 21 figs., 38 refs. Fayetteville, Ark., June 1936. [Recd. 1937.]

Investigations on Tabanids have been carried out in Arkansas since 1927 [*cf. R.A.E.*, B **19** 96]. A list is given of the 47 species (belonging to 4 genera) that have been collected, with notes on the relative abundance, distribution, seasonal prevalence and bionomics of a number of them [*cf.* **25** 126]. *Tabanus costalis*, Wied., and *T. lineola*, F. [*cf.* **19** 195] cause the greatest injury to stock and have constituted 60 per cent. of all Tabanids collected from animals in the State over a period of years. Other species of considerable economic importance are *T. atratus*, F. [*cf.* **21** 9], *T. sulcifrons*, Macq. [*cf.* **24** 101], *Chrysops parvula*, Daecke, *C. nigra*, Macq., and *T. pumilus*, Macq. The larvae of most of the species studied were found in the mud bordering ponds or sluggish watercourses, but those of *T. annulatus*, Say, were collected from decaying portions of either standing or fallen oak trees, and those of *Goniops chrysocoma*, O.-S., were nearly always taken under a thick mat of dead leaves, either at the surface or in the first inch of soil.

Gibson (A.) & Twinn (C. R.). **Warble Fly Control in Canada.**—*Sci. Agric.* **17** no. 4 pp. 179–198, 2 refs. Ottawa, December 1936.

The incidence of infestation of cattle by the warble-flies, *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., in the Prairie Provinces and British Columbia is reviewed, and a detailed account is given of the successful results of control campaigns carried out between 1932 and 1936 in British Columbia, Ontario [*cf. R.A.E.*, B **24** 43] and Quebec. These showed that a satisfactory reduction in the numbers of larvae per animal can be obtained by 2–4 thorough applications of a wash consisting of standardised derris powder, soft soap and water [*cf.* **18** 204].

REGENDANZ (P.). **Ueber den Entwicklungsgang von** *Babesia bigemina* **in der Zecke** *Boophilus microplus.* [On the Course of Development of *Piroplasma bigeminum* in the Tick, *B. annulatus microplus.*]—*Zbl. Bakt.* (1 Orig.) **137** no. 8 pp. 423–428, 5 refs. Jena, 9th November 1936.

Boophilus annulatus microplus, Can., which transmits bovine piroplasmosis caused by *Piroplasma* (*Babesia*) *bigeminum* in Brazil, develops from larva to adult on a single animal. It is therefore never exposed during development to a temperature lower than that of the host, and so matures more quickly than do ticks that drop to the ground to moult. The shortest period observed by the author from attachment of the larva to the dropping-off of the female adult was 21 days, and the longest 41 days. In experiments in Rio de Janeiro, a calf did not become infected with piroplasmosis when numerous larvae obtained from various adults were placed on it. These larvae included some that were the offspring of two female ticks from an animal that had been inoculated with infected blood for immunisation purposes. The calf was subsequently infected by inoculation; the piroplasms appeared in its blood after 6 days and occurred in varying numbers for the next 10 weeks. Observations of ticks fed on it showed that the development of *P. bigeminum* in the tick, up to the time that it enters the eggs, is similar to that of *P. canis* in *Dermacentor reticulatus*, F. [*R.A.E.*, B **21** 76] and *Rhipicephalus sanguineus*, Latr. [**24** 143], but that it is rarer, so that only a few of the eggs are infected.

DAVIS (G. E.) & KOHLS (G. M.). *Ixodes ricinus californicus* (**Banks**) **a possible Vector of** *Bacterium tularense.*—*Publ. Hlth Rep.* **52** no. 10 pp. 281–282, 1 ref. Washington, D.C., 5th March 1937.
KOHLS (G. M.) & COOLEY (R. A.). **North American Records of the Tick** *Ixodes ricinus californicus* (**Banks**).—*T.c.* pp. 282–284, 7 refs.

In the first paper is recorded the finding of two adults of *Ixodes ricinus californicus*, Banks, naturally infected with *Bacterium tularense*, on a dead jack rabbit (*Lepus californicus*) in Oregon in April 1936. This tick infests species of rodents known to be commonly infected with tularaemia in nature and the adults bite man.

Records relating to the hosts and distribution of *I. ricinus californicus* taken from the literature [*cf. R.A.E.*, B **22** 37, 162; **23** 209] and from data collected by the staff of the Rocky Mountain Laboratory are given in the second paper. The latter include records of the immature stages from various rodents [*cf.* **22** 162].

SLACK (H. D.). **Note on Scottish Hemiptera-Heteroptera.**—*Scot. Nat.* no. 225 p. 91. Edinburgh, 1937.

In June 1936, *Cimex columbarius*, Jen., was found infesting rat cages at the Institute of Animal Genetics in Edinburgh. It was suggested by W. E. China, who identified it, that it is a physiological subspecies of *C. lectularius*, L., dependent on environment. On this hypothesis, *C. columbarius* from an avian host tends to become more like *C. lectularius* when transferred to a mammal.

PAPERS NOTICED BY TITLE ONLY.

HÜBNER (F.). **Ueber den Parasitenbefall des Rehwildes in Ostpreussen.** [On the Infestation of Deer by Parasites (including *Cephenomyia stimulator*, Clark, and *Hypoderma diana*, Brauer) in East Prussia.] —*Z. Parasitenk.* **9** no. 3 pp. 424–427, 2 refs. Berlin, 28th April 1937.

RISTORCELLI (A.). **Sur la présence à Toulouse de** *Phlebotomus perniciosus*.—*Arch. Inst. Pasteur Algérie* **14** no. 4 p. 426, 1 ref. Algiers, 1936.

PARROT (L.). **Notes sur les phlébotomes. XXII. Présence de** *Phlebotomus perniciosus* **dans le département de l'Indre.**—*Arch. Inst. Pasteur Algérie* **14** no. 4 p. 427. Algiers, 1936. [*Cf. R.A.E.*, B **23** 179, 272.]

ANTUNES (P. C. A.). **A new** *Anopheles* [*Lophopodomyia squamifemur*, subgen. et sp. n.] **and a new** *Goeldia* [*lanei*, sp. n.] **from Colombia (Dipt. Culic.)**.—*Bull. ent. Res.* **28** pt. 1 pp. 69–73, 2 figs., 7 refs. London, March 1937.

PEUS (F.). *Aëdes cyprius* **Ludlow** (=*A. freyi* **Edwards) und seine Larve (Dipt., Culicidae)**.—*Arch. Hydrobiol.* **31** no. 2 pp. 242–252, 2 figs., 15 refs. Stuttgart, 1937.

FAIRCHILD (G. B.). **A preliminary List of the Tabanidae (Diptera) of Florida.**—*Florida Ent.* **19** no. 4 pp. 58–63. Gainesville, Fla, February 1937.

SCHULZE (P.). **Die erste Zecke von einer Salangane,** *Ixodes collocaliae* **n. sp. von Neupommern.** [The first Tick from *Collocalia spodiopygia reichenowi*, *I. collocaliae*, sp. n., from New Britain.]—*Orn. Mber.* **45** no. 3 pp. 77–80, 5 figs. Berlin, 1937.

FAHRENHOLZ (H.). **Die Nomenklatur der Läuse des Menschen.** [Nomenclature of Anoplura infesting Man (survey of the alteration of names in literature).]—*Arch. Naturgesch.* (N. F.) **5** no. 4 pp. 663–667, 25 refs. Leipzig, 31st December 1936.

FAHRENHOLZ (H.). **Zur Systematik der Anopluren.** [On the Classification of Anoplura.]—*Z. Parasitenk.* **9** no. 1 pp. 50–56, 28 refs. Berlin, 15th December 1936.

IOFF (I.). **Zur Systematik der Flöhe aus der Unterfamilie Ceratophyllinae.** [On the Classification of Fleas of the Subfamily CERATOPHYLLINAE.]—*Z. Parasitenk.* **9** no. 1 pp. 73–124, 73 figs., 1 fldg table, 14 refs. Berlin, 15th December 1936. **Berichtigung zur Arbeit I. Ioff:** [Correction to above article.]—*T.c.* no. 3 p. 438. 28th April 1937.

HENNIG (W.). **Die morphologische Deutung des männlichen Kopulationsapparates der Gattung** *Glossina*. [The morphological Significance of the male copulatory Organs in *Glossina*.]—*Z. Parasitenk.* **9** no. 3 pp. 345–350, 2 figs., 6 refs. Berlin, 28th April 1937.

WAGNER (J.). **Zwei neue** *Rhopalopsyllus***arten nebst einigen Bemerkungen über diese Gattung.** [Two new Species of *Rhopalopsyllus* (*R. pygaerus* on *Didelphys aurita* and *R. pradoi* on *Nasua socialis* in Brazil) with Observations on the Genus.]—*Z. Parasitenk.* **9** no. 3 pp. 418–423, 2 figs. Berlin, 28th April 1937.

FORTNER (G.). **Zur Ernährungsfrage der Simulium-Larve.** [On the Nutrition of Larvae of *Simulium*.]—*Z. Morph. Oekol. Tiere* **32** no. 2 pp. 360–383, 8 figs., 23 refs. Berlin, 18th January 1937.

The author describes investigations on the method and mechanism by which the larvae of *Simulium* spp. obtain food.

MAZZA (S.). **Investigaciones sobre la enfermedad de Chagas. II. Posición sistemática de** *Eutriatoma* (*Triatoma*) *patagonica* (**Del Ponte 1929**) **nov. comb.**—*Publ. Misión Estud. Pat. reg. argent. Jujuy* no. 30 pp. 5–29, 20 figs., 1 map. Buenos Aires, 1937.

On the basis of characters of the rostrum, *Triatoma patagonica*, Del Ponte, is placed in the genus *Eutriatoma*. Its observed distribution is confined to Argentina and extends from 28 to 44 or possibly 46° S. lat. The nymphs and eggs, and a method of taking measurements of the rostrum from photomicrographs are described, and an account is given of the experimental infection of the bug with *Trypanosoma* (*Schizotrypanum*) *cruzi*.

MAZZA (S.) & JÖRG (M. E.). **Investigaciones sobre la enfermedad de Chagas. II. 1a Nota sobre representantes argentinos de la familia Triatomidae** (**Hem. Het.**).—*Publ. Misión Estud. Pat. reg. argent. Jujuy* no. 31 pp. 32–50, 14 figs. Buenos Aires, 1937.

Descriptions are given of distinctive characters of *Neotriatoma limai*, Del Ponte, *Panstrongylus seai*, Del Ponte, and *Eratyrus eratyrusiforme*, Del Ponte, together with records of their distribution in Argentina.

ASHMORE (S. A.) & HUGHES (A. W. McK.). **Use of certain Coal-tar Naphtha Distillates for Destruction of Bed-bugs.**—*Brit. med. J.* 1937 (1) p. 459; also in *Lancet* **232** no. 5922 p. 530. London, 27th February 1937.

Experiments in the laboratory and in houses have shown that the vapours of certain coal-tar naphtha distillates are lethal to *Cimex lectularius*, L., and tests in which animals kept for long periods in an atmosphere saturated with the vapours were not in any way injuriously affected indicate that they are probably not toxic to man. The rooms of infested houses are made gas-tight by any of the usual methods of sealing, and the walls and ceilings sprayed with the distillate, a high pressure hand syringe being employed for treating such objects as skirting boards, architraves, etc., where the bugs are most likely to hide. Gas masks with a suitable filter are worn during the process. To ensure satisfactory results, it is important that sufficient concentration of vapour be maintained, and fumigation should not, therefore, be carried out at a temperature of less than 60°F.; it is advantageous to work at higher temperatures where practicable. Except in very hot weather when the air temperatures are 70–80°F., the walls and ceilings of the rooms should be heated artificially; a paraffin stove working on the primus principle was found to be effective. Since the naphtha vapour is inflammable, all sources of heat and all naked lights should be removed from the room before fumigation. After a house has been warmed, it has been found advisable in most instances to spray the roof space before the rooms are treated.

One gallon naphtha is used to 750 cu. ft. space. The rooms are kept sealed for 24 hours and then rapidly ventilated; the vapour clears very quickly, and it is possible to enter a room after a few minutes' ventilation without experiencing any discomfort.

Successful results have been obtained in the fumigation of more than 200 houses and flats of varied constructional detail, and where failures have been reported, they are believed to have been due to defects in the method of treatment. The specification for the heavy coal-tar naphtha is as follows: it shall be free from water and other visible impurities, and contain not more than 0·25 per cent. tar acids and 0·25 per cent. tar bases; the colour shall be not darker than a freshly prepared solution of 1 ml. of N/10 iodine in 1,000 ml. distilled water; the specific gravity not less than 0·835 or greater than 0·910; the distillation range (by the method defined in B.S.I. specification no. 479 for coal-tar naphthas) up to 160°C. not more than 5 ml., and up to 190°C. not less than 90 ml.; and the flash-point (Abel) not less than 105°F. Further work on the use of heavy coal-tar naphthas for the destruction of bed-bugs is in progress, and methods for more effective application are in course of development.

Gregson (J. D.). **Studies on the Rate of Tick Feeding in Relation to Disease.**—*Proc. ent. Soc. B. C.* no. 33 pp. 15–21, 2 figs. Victoria, January 1937.

Tick paralysis is prevalent in southern Alberta, British Columbia and the north-western part of the United States, and in these areas it is caused by *Dermacentor venustus*, Banks (*andersoni*, Stiles). In British Columbia, 8 deaths in man have been reported, and there are a number of minor cases in children every year; sheep, dogs and cattle are particularly susceptible, and two serious outbreaks have occurred in cattle [see next abstract]. The paralysis may be caused by the feeding of a single tick, but the symptoms only appear when it has been engorging for about 7 days and is nearing repletion. The onset is sudden and characterised by acute ascending motor paralysis. Pulse and breathing are rapid, there is slight glandular disturbance and an absence of pain. Death usually occurs in 24–60 hours from paralysis of the thoracic organs, but if the tick is removed recovery is usually complete and rapid (4–24 hours). The affection is generally thought to be due to the rapid injection of a salivary toxin and should logically accompany any rapid feeding on the part of the tick [*cf.* *R.A.E.*, B **14** 10]. In British Columbia, it is produced only by ticks that engorge quickly and drop at the end of 7–8 days. The rate of feeding varies with the individual tick, and the feeding period in ticks of common origin feeding under apparently identical conditions often varies from 7 to 18 days. It also varies with the season; all ticks engorge readily in spring in about 9 days, but towards the autumn and during the winter months, although apparently willing to feed, they are unable to do so.

An experiment is described in which adult ticks from the same stock were fed on a lamb at the same time and a series of sections were made of the tissues taken below the feeding points of ticks that were partly and wholly engorged. From examination of the sections, it appeared that very little mechanical disturbance resulted from the feeding, the mouth-parts rarely penetrating beyond the epidermal layer, but rapid feeding produced acute inflammation in the underlying

dermal tissues (intense leucocytosis occurred round the blood vessels, the capillaries were very dilated and a haemorrhagic area of haemolysed blood was usually present), whereas when feeding was slow little or no change was observed. Capillary counts were similar in both series. It would appear from these results that the inability of certain ticks to feed rapidly is due to a lack of the power to produce sufficient disturbances within the tissues to cause a liberation of blood. Since mechanical disturbance produced by its feeding is very slight and its mouth-parts do not penetrate deeply enough to obtain blood from the capillary bed, a tick is entirely dependent on the production of an oedema and haemorrhage for its access to the blood fluid. It possibly produces these injuries by the elaboration of a powerful toxin. Objects that appear to be symbiotic yeasts have recently been observed within the digestive epithelium of engorging ticks. It is probable that they play an important part in the assimilation of blood by the tick, and may be connected with its rate of feeding.

Moilliet (T. K.). **A Review of Tick Paralysis in Cattle in British Columbia, with Notes on several new Cases.**—*Proc. ent. Soc. B.C.* no. 33 pp. 35–39, 6 refs. Victoria, January 1937.

Only isolated cases of tick paralysis had occurred in cattle in British Columbia prior to 1930, but in April of that year an outbreak affected 100 animals out of a herd of 900 yearling steers and 65 died [*R.A.E.*, B **22** 42]. An account is given of another serious outbreak that occurred in the same region in April 1934 ; 200 yearling steers out of a herd of 638 were affected and 26 died. Large numbers of ticks were removed from the animals, and a mixture of 1 part creosote, 2 parts kerosene and 1 part raw linseed oil was rubbed along the neck and back to kill the remaining ticks and to act as a repellent dressing. Most of the animals recovered within a few hours after the ticks were removed. Smaller losses that may have been attributable to tick paralysis were reported from two other herds. The two serious outbreaks are compared. There can be no doubt that *Dermacentor venustus*, Banks (*andersoni*, Stiles), the only tick involved in this region, is becoming more abundant, partly owing to the increase in the numbers of domestic animals since the country was settled, and partly to the increase in the numbers of the rodents that are the hosts of its immature stages.

Spencer (G. J.). **The Menace of Rat Parasites in Vancouver in 1936.**—*Proc. ent. Soc. B. C.* no. 33 pp. 44–45. Victoria, January 1937.

Since 1930, the frequency of rubbish collection in Vancouver has been reduced as a result of the economic depression, and *Mus* (*Rattus*) *norvegicus* has increased in numbers and spread practically throughout the City. *Ceratophyllus fasciatus*, Bosc, *Polyplax spinulosa*, Burm., and *Liponyssus bacoti*, Hirst, have been collected from this rat in the City area. During the winter and spring of 1935–36, a large shop became infested with *L. bacoti*, which attacked the employees, particularly on the arms and round the ankles. The main source of the infestation was cartons of merchandise in the basement where the rats made their nests ; from these breeding centres the mites had spread to all parts of the building, crawling rapidly by night and generally hiding during the day in cracks and crevices. This appears

to be the first record of such an infestation in Canada. A second severe infestation of mites, probably belonging to the same species, occurred shortly afterwards in a large office building.

KIRK (J. B.). **The Relation of Shade to the natural Breeding Places of** *Anopheles costalis* **in Mauritius.**—*Ann. trop. Med. Parasit.* **31** no. 1 pp. 1–6, 1 pl., 2 refs. Liverpool, 8th April 1937.

In view of Blacklock's account of the successful control of *Anopheles minimus*, Theo., obtained by growing dense shade plants over streams in Assam [*cf. R.A.E.*, B **24** 277], the author describes how a similar measure in Mauritius has been found to prevent the breeding of *A. gambiae*, Giles (*costalis*, auct.). The watercourses of the Island are periodically subjected to sudden flooding as a result of cyclonic storms, and this has led to the planting of a belt of shade trees of varying depth on each side of rivers and streams to prevent soil erosion. At one time it was thought that this would produce conditions favourable to Anopheline breeding, but by 1919 it had been found that *A. gambiae*, the most important vector of malaria, did not breed in shaded streams [*cf.* **10** 225], though its larvae could be found in parts of the same streams exposed to the sun. This observation has since been confirmed, and there is now no doubt that well-maintained "river reserves" are a valuable anti-malaria measure. It has also been found that light shade is almost as effective a deterrent to oviposition as dense shade. The explanation may be that the growth of the organisms on which the larvae of certain Anophelines feed is dependent on a definite minimum exposure of the water to sunlight, and that, although some direct sunlight may reach the water in the course of the day, if the amount is below the minimum requirement, no growth will occur. This method is also effective along rivers, since the larvae are found chiefly at the edges and seldom in midstream, where the current acts as a deterrent. In Mauritius, *Eugenia jambos* is the most suitable tree for planting, because its branches tend to arch over the water. *A. funestus*, Giles, which also occurs in Mauritius, prefers densely shaded water for breeding, but it has a much more restricted range than *A. gambiae*, and does not appear to be of any great local importance in the transmission of malaria.

ADLER (S.), THEODOR (O.) & SCHIEBER (H.). **Observations on Tick-transmitted human Spirochaetosis in Palestine.**—*Ann trop. Med. Parasit.* **31** no. 1 pp. 25–35, 3 refs. Liverpool, 8th April 1937.

Records of 45 cases of relapsing fever associated with caves that have occurred in Palestine since 1927 are discussed. Ticks from the cave in which 13 of the cases were infected were identified as *Ornithodorus papillipes*, Bir. Four persons were infected by the bites of larvae in nature, so that infection must pass through the egg. Moreover, the infection was transmitted in laboratory experiments by larvae and nymphs reared from infected females. Many of the larvae are not infective, possibly because spirochaetes are not present in the salivary glands or because a number of the eggs from infected females are uninfected. Engorgement in all stages usually takes about 15–30 minutes. Neither coxal fluid nor faeces are passed while the tick is attached to its host, but a copious amount of coxal fluid is passed a few moments after detachment. Of two experiments in which coxal fluid from a single female was injected into a guineapig, one gave

positive results. Moskwin [*R.A.E.*, B **17** 226] was of the opinion that after 12 days no spirochaetes are found in *O. papillipes*, although the tick is still infective 127 days after the infecting feed, but the present authors found spirochaetes in material from wounds in a rat made by the bites of ticks fed 67 days previously. The relapsing fever studied resembled the Central Asiatic and Persian types rather than the Mediterranean ones, and the spirochaete would appear to be *Spirochaeta persica* (*sogdiana*).

KLIGLER (I. J.) & MER (G.). **Studies on the Effect of various Factors on the Infection Rate of** *Anopheles elutus* **with different Species of** *Plasmodium*.—*Ann. trop. Med. Parasit.* **31** no. 1 pp. 71–83, 2 refs. Liverpool, 8th April 1937.

The results are given of experiments carried out in Palestine over a period of 2½ years on the infection of *Anopheles sacharovi*, Favr (*elutus*, Edw.) with *Plasmodium vivax*, *P. falciparum* and *P. malariae*. As it is becoming increasingly apparent that the biology of adult Anophelines varies with the season and is greatly influenced by the conditions under which they breed, the mosquitos used in the experiments were bred in containers kept out-of-doors and so subject to the variations in temperature, food, etc., characteristic of the period when the experiments were carried out. Although the data are limited, they indicate that *A. sacharovi* varies in its susceptibility to infection with the three species of *Plasmodium* ; the total percentages infected were 57·9 with *P. vivax*, 27·7 with *P. falciparum* and 8·4 with *P. malariae*. Moreover, they suggest that it shows differences in susceptibility to the same species of parasite at different seasons of the year ; the percentage of mosquitos infected with *P. falciparum* and *P. malariae* was 0 in May and highest (51·6 and 15·7, respectively) in June ; with *P. vivax* it was highest (100) in May and lower (29) in June. The three species of *Plasmodium* appear to have different optimum temperatures for their development and different rates of development at a given temperature. At a mean of 15°C. [59°F.], *P. falciparum* does not develop, whereas development of *P. vivax* is slow but definite ; at a mean of 19°C. [66·2°F.], sporozoites are produced by the former in 35 days and by the latter in 24 days. The higher temperature required for development may account for the absence of infections with *P. falciparum* in May. *P. malariae* develops most slowly ; it requires at least 27 days at a mean of 24°C. [75·2°F.] as compared with 18 days required by *P. falciparum*. Atebrin resembles quinine in its failure to affect the gametocytes of *P. falciparum* ; it does not prevent the infection of *A. sacharovi* fed on patients under treatment.

EVANS (A. M.) & SYMES (C. B.). *Anopheles funestus* **and its Allies in Kenya.**—*Ann. trop. Med. Parasit.* **31** no. 1 pp. 105–111, 1 map, 6 refs. Liverpool, 8th April 1937.

The following is taken chiefly from the authors' summary : Three members of the series of *Anopheles funestus*, Giles, can definitely be recorded from Kenya, the type form, which is common and widely distributed, and *A. rivulorum*, Leeson, and *A. leesoni*, Evans, which by comparison may be described as localised or rare [*cf. R.A.E.*, B **25** 105]. It is probable that, at least in most parts of the Colony, the type form is the only one that is found in appreciable numbers in huts or houses ; thus there is little doubt that records of natural

malaria infectivity in *A. funestus* in Kenya [*cf.* **20** 208] apply to it. Many of the larvae reared from eggs at Kisumu were abnormal in having the paired platelets isolated from the main plate on some or all of segments IV–VI; this condition was extremely rare among caught larvae. For this reason too much reliance should not be placed on the characters of reared larvae unless they are checked against those of larvae found in nature.

MURGATROYD (F.) & YORK (W.). **Studies in Chemotherapy. XV.—Observations on the Loss of Transmissibility by** *Glossina morsitans* **of** *T. brucei* **maintained in a European Laboratory.**—*Ann. trop. Med. Parasit.* **31** no. 1 pp. 173–194, 8 refs. Liverpool, 8th April 1937.

The following is taken from the authors' summary: Evidence is produced to show that a strain of *Trypanosoma brucei* isolated from wild examples of *Glossina morsitans*, Westw., in 1931, and subsequently maintained in Liverpool by passage through guineapigs, partly by blood inoculation and partly by the bites of *G. morsitans*, remained transmissible by the fly for at least 4 years and then became non-transmissible. Analysis of the results of dissecting flies used in the transmission experiments showed that in about 90 per cent. of the cases in which the trypanosomes became established outside the peritrophic membrane, the infection spread forwards to the proventriculus. In only about 20 per cent. of the cases in which the proventriculus was involved were the salivary glands also invaded. This could not be explained by the hypothesis that the flies that exhibited only a "gut + proventriculus" infection had not lived long enough for the trypanosomes to reach the salivary glands. In all instances in which it was possible to examine the point, the salivary glands had become infected by the 26th day or earlier. This observation agrees with Duke's statement that, if the trypanosomes are going to invade the salivary glands, they will have done so by the 30th day after the infecting meal [*cf. R.A.E.*, B **21** 279]. Considerable numbers of flies were encountered in which proventricular infection had persisted long beyond this period without spreading forward to the salivary glands. It thus appeared that establishment of the trypanosomes in the ectoperitrophic space implied that, in all probability, the infection would reach the proventriculus [*cf.* **24** 182], but proventricular infection did not necessarily imply that the salivary glands would eventually become infected. The stages by which the strain of *T. brucei* became non-transmissible would appear to be that it first lost its capacity to migrate from the proventriculus to the salivary glands, then to move forwards in the ectoperitrophic space to the proventriculus, and lastly to establish itself in the ectoperitrophic space.

SIMMONS (J. S.). **Observations on the Importance of** *Anopheles punctimacula* **as a Malaria Vector in Panama, and Report of experimental Infections in** *A. neomaculipalpus*, *A. apicimacula*, **and** *A. eiseni*.—*Amer. J. trop. Med.* **17** no. 2 pp. 191–212, 5 figs., 15 refs. Baltimore, Md, March 1937.

In spite of the expenditure of large sums for the control of malaria in the Panama Canal Zone, there has been no appreciable improvement

in the incidence since 1916, the rates having fluctuated between 11 and 31 cases per 1,000. The higher incidence observed among soldiers, as compared with Canal employees, is probably due to their greater susceptibility and to their exposure at night while on field duty both in the Canal Zone and the Republic of Panama. Anophelines breed abundantly in uncontrolled areas, and some are prevalent in controlled areas each year at the time of their migratory flights. For these reasons the question of vectors is being re-investigated [*cf. R.A.E.*, B **24** 54, 145, 295].

In experiments in which the mosquitos were fed on a patient infected with *Plasmodium vivax*, the numbers examined for oöcysts and those found infected were 25 and 13 of *Anopheles punctimacula*, D. & K. [*cf.* **24** 145], 4 and 0 of *A. albimanus*, Wied., 4 and 1 of *A. pseudopunctipennis*, Theo., and 1 and 1 of *A. eiseni*, Coq. (which is not known to have previously been infected). The corresponding figures for sporozoite infections were 25 and 6, 5 and 0, 4 and 0, and 1 and 0. In experiments in which the mosquitos were fed on a patient infected with *P. falciparum*, the numbers examined for oöcysts and those found infected were 347 and 83, 20 and 9, 73 and 6, and 1 and 0 of the above species and 15 and 0 of *A. apicimacula*, D. & K. The corresponding figures for sporozoite infections were 480 and 27, 18 and 1, 77 and 3, and 18 and 1 of the first three and the last species, respectively; no specimens of *A. eiseni* were examined.

In another experiment with *P. vivax*, the figures for oöcyst infections were 26 and 5 of *A. neomaculipalpus*, Curry [*cf.* **24** 295], and 16 and 2 of *A. albimanus*; the corresponding ones for sporozoite infections were 24 and 2, and 17 and 1.

Information is given on the prevalence, distribution, breeding places, habits, and relation of malaria of *A. punctimacula* [**24** 145].

MATHESON (R.) & HURLBUT (H. S.). **Notes on *Anopheles walkeri* Theobald.**—*Amer. J. trop. Med.* **17** no. 2 pp. 237–242, 1 pl., 11 refs. Baltimore, Md, March 1937.

The literature on *Anopheles walkeri*, Theo. [*R.A.E.*, B **15** 151; **21** 148; etc.] is briefly reviewed. Breeding was noticed in 1932 in a typical marshy pond overgrown with cat-tails [*Typha*] and aquatic vegetation near Ithaca, New York, and observations since that time have revealed small numbers of larvae along the shores during each season. The species is now known to be widely distributed in the eastern part of the United States and in parts of Canada. Although it was reared in relative abundance in August, the colony of adults gradually diminished and finally died out during September-November. Subsequent studies showed that some of the eggs laid in August were larger and differed markedly in appearance from the others; experiments in which larvae were reared from eggs of this type that had been kept at low temperatures until March confirmed the suggestion that they were the overwintering ones. Individual females laid eggs of both types. In 1936, the first adults were taken in June. Mating did not occur in captivity. A female captured on 3rd August took 5 blood meals and deposited 749 summer eggs in 6 batches during the next 23 days, the maximum number in a batch being 336. Adults reared from these eggs and given blood meals were found on dissection

to have eggs of the winter type in their ovaries. A female caught on 14th August and given a blood meal 2 days later began to deposit winter eggs on 26th August, and laid 601 in 5 batches in 29 days, receiving a total of 5 blood meals. Of 1,199 summer eggs laid between 23rd July and 25th August, 88·8 per cent. hatched. All summer eggs that have been frozen have so far failed to hatch. Of 1,134 winter eggs laid between 26th August and 13th September, less than 0·8 per cent. hatched during the same season, whether they were kept out-of-doors or at about 70°F.

Boyd (M. F.) & Kitchen (S. F.). **A further Note on the Infectiousness of Anopheline Mosquitoes infected with *P. vivax* and *P. falciparum*.**—*Amer. J. trop. Med.* **17** no. 2 pp. 245–251, 1 ref. Baltimore, Md, March 1937.

The extent to which Anophelines infected with malaria parasites can be depended upon to infect the patients to whom they are applied is of considerable importance in their use in malaria therapy, as well as a matter of distinct epidemiological significance. Observations made up to the end of 1935 are here analysed with a view to determining possible relationships to it of the number of mosquitos applied, the percentage of infected mosquitos in the batches to which they belong (qualitative infection), and the density of the oöcysts on the stomachs (quantitative infection), based on the results of tests on white patients with *P. vivax* and on negro patients with *P. falciparum*. The results are given in tables. They show no significant difference from the use of mosquitos from lots differing in qualitative infection, but this is to be expected, as the application of mosquitos to a patient is continued until one or more demonstrably infected individuals have been applied. When the lots of mosquitos were divided into those having less than 30 oöcysts on the stomach (poor), those in which one-half had more than 50 oöcysts (good) and those in which the density of the oöcysts was between the two (fair), the percentages of positive results for poor, fair and good lots were 80·8, 84·8 and 92·8, respectively, with *P. vivax*, and 66·6, 61·8 and 44·4 with *P. falciparum*. The higher the qualitative infection of a lot, the greater will be the degree of its quantitative infection. From the table showing the percentages of positive results in relation to the number of days elapsing since the first detection of parasites in the salivary glands (age of sporozoites), it is clear that no patients were infected when mosquitos harbouring *P. vivax* were stored in a refrigerator for more than 50 days nor when those harbouring *P. falciparum* were similarly stored for more than 30 days. It is stated that the record in a previous paper [*R.A.E.*, B **24** 145] of a successful inoculation with sporozoites 31–40 days old was erroneous. The percentages of positive results (eliminating inoculations with sporozoites that were too old) among the lots with poor, fair and good quantitative infections were 83·9, 88·3 and 92·8, respectively, for *P. vivax* and 70, 70·6 and 53·2 for *P. falciparum*. The best results with sporozoites of *P. vivax* were obtained when they were less than 20 days old and with those of *P. falciparum* when they were less than 10. There was some evidence that the likelihood of transmission increases with the number of mosquitos applied, but that this trend is slight in the case of *P. falciparum*, and applies to sporozoites less than 10 or more than 20 days old in the case of *P. vivax*.

Boyd (M. F.) & Kitchen (S. F.). **On the Infectiousness of Patients infected with** *Plasmodium vivax* **and** *Plasmodium falciparum*.—*Amer. J. trop. Med.* **17** no. 2 pp. 253–262, 4 graphs, 3 refs. Baltimore, Md, March 1937.

A knowledge of the minimum leucocyte-gametocyte ratios in the blood of a patient infected with *Plasmodium vivax* or *P. falciparum* that will ensure satisfactory infection of mosquitos [*cf. R.A.E.*, B **23** 284] is of importance for a malaria-therapy service, but the important information from an epidemiological point of view is the minimum gametocyte density that can produce infection in Anophelines. To determine this, lots of *Anopheles quadrimaculatus*, Say, were applied daily or every other day to 4 patients (2 of whom were infected with *P. vivax* and 2 with *P. falciparum*) throughout the duration of their clinical attack and for some time afterwards. In the first case infected with *P. vivax*, parasites were detected 14 days after inoculation, and the clinical attack lasted 11 days. Each day for 17 days subsequent to the first discovery of parasites, a lot of 10 mosquitos was applied. Gametocytes were first observed 16 days after inoculation of the patient, they rapidly increased to a maximum exceeding 600 per cu. mm. and were last detected on the 26th day. Mosquitos applied prior to the appearance of gametocytes did not become infected, but the first lot applied after the last gametocytes were detected became infected, the patient being thus infective when the number of gametocytes per cu. mm. blood was less than 10. In the second case, gametocytes were first observed on the 14th day and were detectable microscopically as late as the 74th day, though they then numbered less than 10 per cu. mm. Mosquitos applied on the 15th day were the first to become infected, and the lots continued to become infected even after the numbers of gametocytes were reduced to sub-microscopic densities ; for the greater part of the period all mosquitos applied were infected with an intense quantitative infection. In the first case infected with *P. falciparum*, gametocytes were first noted on the 23rd day after inoculation (the 9th day after first detection of parasites) and were continuously present for 27 days. The patient only became infective to mosquitos late in the clinical attack and after the gametocytes had been present for 3 days, and ceased to be infective 4 days before they disappeared. The initial infections were obtained with gametocyte densities of about 400 per cu. mm. and the final ones with densities of about 40. In the second case infected with *P. falciparum*, the temperature rose to such a height that quinine was given on the 6th and 7th days after parasites were first observed (the 3rd and 4th days of the clinical attack). Gametocytes were not seen until the 11th day after the first parasites and then only in small numbers for 9 days. On the 12th day after the last dose of quinine, the parasite density had again become sufficient to induce a clinical attack, but no gametocytes were observed ; their numbers increased, however, after the attack was over, and a third, lesser rise occurred at the time of the third attack. Mosquitos were applied from the onset of the first attack until the middle of the third. None became infected during the first wave of gametocytes but infections occurred during the second half of the second wave when the density was at or above 100 per cu. mm. ; the infective period may have lasted 7–9 days. The marked lag between the first appearance of trophozoites and the first appearance of gametocytes is a constant characteristic of *P. falciparum*, and

since gametocyte density may be highest at a time when trophozoites are practically undetectable microscopically, gametogeny would appear to be fundamentally different from that of *P. vivax*.

From a table showing the number of mosquitos that became infected at different gametocyte densities, it appears that, in the case of *P. vivax*, 19 out of 64 became infected when no gametocytes were visible, 45 out of 62 when the density was less than 25 per cu. mm., and 148 out of 208, and 286 out of 339 when the densities were 26–100 and 101–500 respectively. At the last 3 densities, 2, 31 and 179 of the infected mosquitos had more than 50 oöcysts on the stomach. With *P. falciparum*, no infections occurred at densities of less than 25, and the figures at densities of 26–100, 101–500 and more than 500 were 7 out of 65, 46 out of 128 and 13 out of 25, respectively. None of the infected mosquitos showed more than 50 oöcysts on the stomach. It would seem that gametocytes are produced at every period of multiplication of *P. vivax*, whereas they appear at the end of 5–6 cycles of trophozoite multiplication in *P. falciparum*.

Butts (D. C. A.). **Malaria in Camden County, New Jersey. Report of a recent Outbreak.**—*Amer. J. trop. Med.* **17** no. 2 pp. 279–287, 5 figs., 4 refs. Baltimore, Md, March 1937.

An account is given of an epidemic of malaria (120 cases) that occurred during the late summer of 1935 in an area of Camden County, New Jersey. Only 61 cases had been reported from this county between 1912 and 1934. Collections of adult Anophelines begun on 11th September revealed the presence of *A. quadrimaculatus*, Say, *A. punctipennis*, Say, and *A. crucians*, Wied. Of 2,748 mosquitos caught by hand and in traps between this date and 28th September, 53 were female Anophelines. By the time the survey of adult mosquitos was completed, the breeding season was over and it was not possible to obtain much information on breeding places. The fact that many of the points at which it was desired to place traps were situated far from sources of electric power, led to the development of a portable trap with a standard storage battery to supply current for the light and the suction fan. The necessity for carrying out effective control measures to prevent this area becoming an endemic focus of malaria is emphasised.

Watson (R. B.) & Spain (E. L.). **Studies on Malaria in the Tennessee Valley. The Influence of Physiography on the Occurrence of Breeding Places of *Anopheles quadrimaculatus* in northern Alabama.**—*Amer. J. trop. Med.* **17** no. 2 pp. 289–305, 5 figs., 8 refs. Baltimore, Md, March 1937.

The part of the Tennessee River (approximately 195 miles in length) that lies within the State of Alabama will soon be converted into lakes by means of four dams ; the back-water from one dam will reach the dam next above and the total shore line will be more than 2,000 miles long [*cf. R.A.E.*, B **24** 130]. Studies on malaria and mosquito breeding have been carried out since 1934 in zones that will be within two miles of the lakes, and the results are here given of investigations on the relation of the physiography of the region to the breeding of *Anopheles quadrimaculatus*, Say. The preferred breeding places of this

mosquito are partly-shaded, still pools of clean water, with a neutral or slightly alkaline reaction, containing aquatic vegetation, débris, and an abundant plankton. In northern Alabama, the larvae are usually found in "limesink" ponds [*cf.* **21** 148], in stagnant pools formed in the beds of shallow streams during droughts or by the isolation of loops when the stream cuts a more direct course during a flood, and, finally, in shallow channels made by flood water, which often hold water for a long time after the floods have receded. These types of breeding places are discussed; spring-fed limesink ponds are the most important and meandering streams the least. It is pointed out that the degree to which breeding places are formed in limesinks depends on their natural drainage. If the bottom of the depression is well above the general ground water table and the opening into the underground channels is not obstructed, surface water draining into it may flow rapidly away, leaving no standing water. If, however, the natural outlets have been obstructed by fine clay washed from the top soil by the surface run-off, the accumulated water filters through very slowly and a pond is present at all times except during prolonged drought. When the level of the natural drainage is the same as, or below, the ground water table, a permanent pond is formed, which is fed by the water table as well as the surface run-off. For these reasons limesinks forming ponds develop on a surface of little relief, and permanent ponds are more prevalent when the water table lies close to the surface. The rock types and physiography of northern Alabama are described and shown on a map, and their relation to the formation of breeding places and the probable effect on the latter of impounding the water are discussed. It is believed that, with the application of modern anti-larval operations throughout the breeding season, the potentialities for malaria transmission will be diminished rather than increased by the creation of the lakes.

WOKE (P. A.). **Effects of various Blood Fractions on Egg Production of** *Aëdes aegypti* **Linn.**—*Amer. J. Hyg.* **25** no. 2 pp. 372–380, 14 refs. Baltimore, Md, March 1937.

The experiments described were undertaken to determine the effect on egg-production of feeding *Aëdes aegypti*, L., on whole blood, the principal components of whole blood, or blood modified by the addition of chemicals or by other methods commonly employed to prevent or retard its coagulation. The mosquitos were fed through a membrane. Eggs were deposited after a meal of rat blood without additional food and probably without water. When the blood was diluted with water, the number of eggs laid was reduced proportionately. All the mosquitos fed on blood treated with sodium fluoride died immediately after feeding. The average numbers of eggs laid by mosquitos fed on rabbit blood treated with sodium oxalate, ammonium oxalate, a mixture of potassium and ammonium oxalates, sodium citrate, and heparin were 90·5, 102·7, 113·8, 110·7 and 117·3, respectively, as compared with 106·6 and 108·8 laid by those fed on untreated whole blood and on defibrinated blood. When the mosquitos were fed on two lots of erythrocytes from rabbit blood, erythrocytes from fowl blood, and plasma, serum, and haemoglobin from red cells, all from rabbit blood, the average numbers of eggs deposited were 50·7, 67·6, 86·8, 37·9, 62·4 and 65·1, respectively.

CAUSEY (O. R.). **Some Anopheline and Culicine Mosquitoes of Siam with Remarks on Malaria Control in Bangkok.**—*Amer. J. Hyg.* **25** no. 2 pp. 400–420, 21 refs. Baltimore, Md, March 1937.

The material for this study of the mosquitos of Siam [*cf. R.A.E.*, B **19** 205; **21** 89] was collected from the northern, central and southern parts of the country between August 1931 and July 1935. Adults were bred from larvae and were also taken in light traps in houses and on animal baits. As a comprehensive survey of the Anophelines of the interior was recently made by Anigstein [**21** 89], the author limits his discussion to the species found in Bangkok, since his observations there were based on collection over a longer period.

Repeated examinations of the numerous waterways in the City showed that those in which tidal water circulated freely were never used as breeding places. Moreover, no breeding took place in channels almost filled with deposits of silt evenly distributed by the passage of small boats during the high tides of the rainy season; in these, water hyacinth [*Eichhornia crassipes*] easily becomes established in the dry season and forms a complete canopy over the surface of the water. The relation between this plant and Anopheline breeding has been debated; the author's observations on certain canals showed that a few larvae of *Anopheles barbirostris*, Wulp, and *A. hyrcanus* var. *nigerrimus*, Giles, might be found under it, but that algae, *Pistia* and other water weeds grew up when it was removed, and not only did the numbers of these Anophelines increase, but *A. vagus*, Dön., and *A. aconitus*, Dön., also appeared. Because they contain water hyacinth, obstructed canals are less important as breeding places than excavations and ditches. If the tidal water is completely excluded, the flora of ditches consists of algae, *Pistia* and various other small water weeds; if the water is allowed to circulate through a small subsoil drain, the visible flora is usually limited to *Ceratophyllum*, which forms a dense network throughout the water. In the closed ditches, the larvae usually concentrate in the patches of green algae, but in the semi-open ones, they are distributed over the entire surface where the leaves and stems of the *Ceratophyllum* protect them from fish. In spite of the difference in flora, the mosquito fauna is similar; *A. vagus* and *A. barbirostris* were by far the most numerous species, while *A. annularis*, Wulp, was found among the less abundant ones. Few mosquitos breed in rice-fields under cultivation, *A. barbirostris* being the only species found in fields of young growing rice. When the rice ripens, débris accumulates, and water weeds grow up, other species of Anophelines appear, but they never become abundant, because the rains cease and the fields dry up. Unfortunately, many of the small rice-fields in the vicinity of the City are left uncultivated, and mosquitos breed in large numbers among the abundant and varied vegetation, and later, when the water has almost disappeared, in the hoof marks of grazing buffalos. Mosquito larvae also occur in buffalo tracks filled with water near the edges of irrigation canals. In spite of the greater variety of breeding places in the country, the species taken were similar to those that occurred in the ditches and canals in the City, though their relative abundance varied. *A. hyrcanus* var. *nigerrimus* was three times as numerous in the country, whereas *A. vagus* was twice as abundant in the City. *A. aconitus* also occurred more frequently in the country. The species and numbers of larvae taken in permanent and semi-permanent pools were similar to those found in ditches and irrigation

canals, but when the pools were covered with dense shade, only *A. vagus* and *A. tessellatus* were present.

In collections of larvae and collections of adults from light traps in houses, the percentages of the different species varied ; *A. hyrcanus* var. *nigerrimus* represented 6 per cent. of the larvae, but 40 per cent. of the adults, and the percentage of *A. annularis* was greater in collections of adults. *A. vagus* and *A. barbirostris* were the only species found in smaller percentages among the adults. In addition, *A. philippinensis*, Ludl., *A. kochi*, Dön., and *A. minimus*, Theo., which were not found as larvae, were taken in the traps. The possible malaria vectors are discussed from evidence available from neighbouring countries and from limited observations on Anopheline density and malaria incidence in Bangkok ; *A. annularis* was the most prevalent species in and near the houses of several malaria patients, and Anigstein reported an outbreak in which this species was the only possible vector. Control measures, such as encouraging the free circulation of tidal water, cleaning canals and ditches, etc. [*cf.* **21** 90] are recommended.

A list is given of the Culicines collected in Siam, with notes on such points as the date and place of collection, habitat, etc. Observations on the sex ratio of mosquitos collected in the vicinity of breeding places and at distances of two miles or more indicate that the females migrate further than the males ; this finding can be used in searching for breeding places Sweating animals constituted a better bait than cool rested ones because they attracted male mosquitos as well as a greater number of females.

HICKS (E. P.) & MAJID (S. A.). **A Study of the Epidemiology of Malaria in a Punjab District.**—*Rec. Malar. Surv. India* **7** no. 1 pp. 1–46, 10 charts, 1 fldg. diagr., 20 refs. Calcutta, March 1937.

A malaria survey of the Karnal district of the Punjab begun in 1929 [*cf. R.A.E.*, B **19** 244] was continued, and the results up to April 1936 are analysed. In view of the general belief that the epidemiology of malaria is largely governed by the balance of immunity and infection, an attempt is made to estimate the influence of these factors in a district subject to epidemics. The monsoon usually begins in July and the first considerable increase in malaria incidence in September. The spleen and parasite rates rose to considerable peaks in the autumns of 1933 and 1935 and to lesser ones in those of other years. The average enlarged spleen was considered the best measure of immunity, and it is concluded from data on it, that there was little change in the immunity of the population during the period of the survey. The parasite rate shows that malignant tertian malaria [*Plasmodium falciparum*] reaches its peak in November and gradually declines until the following September ; and that benign tertian [*P. vivax*] reaches its peak in September and also rises between April and June. From a consideration of the numbers, seasonal prevalence and infection rate in the various species of Anophelines collected, it was concluded that *Anopheles culicifacies*, Giles, was the only vector of importance in the district. No infections were found in this mosquito before August, so that it would appear that transmission rarely occurred before that time. The cases of benign tertian in the spring may be relapses from an attack in the previous autumn, or the first appearance of the disease in persons infected in the previous autumn without having a frank attack at that time. The intensity of the epidemic of relapses must

depend on the degree of infection in the previous autumn. The spring epidemic presumably gives rise to a large population of gametocyte carriers on which the mosquitos can become infected as soon as they can transmit the disease. There were only a few carriers of gametocytes of *P. falciparum* in August, when transmission usually began, and no epidemic was possible until their numbers had increased, so that the parasite rate did not begin to rise until September.

The climate of July is important because it determines the time when mosquitos can increase and become infected. The relation between climate and malaria is discussed. There is little malaria when the rainfall in July-August is deficient, but there may or may not be an epidemic when it is normal or excessive. The records for saturation deficiency are more closely correlated with the incidence of malaria; this seems to depend on the length of the period during which the saturation deficiency remains low, which again depends on an even distribution of rainfall. The two years having a maximum incidence of malaria were the only ones having two consecutive months with an afternoon saturation deficiency below 0·4 inch. Wide fluctuations, similar to those shown in the graphs of catches of *A. culicifacies*, are shown only in the graph for afternoon (4 p.m.) saturation deficiency. A rise in saturation deficiency is followed after a week or two by a fall in the catches of *A. culicifacies*. It has been shown that, when temperature is favourable, the length of life of a mosquito varies with the saturation deficiency, and the correlation between saturation deficiency and the numbers of mosquitos caught is therefore thought to be due to its influence on longevity. Thus, when rainfall is actually deficient, the climate is not damp enough to permit any significant amount of transmission; when it is heavy and evenly distributed, there is a long period of saturation deficiency favourable to transmission; and when it is heavy but sporadic, the breaks allow the saturation deficiency to rise and interrupt transmission. A figure to represent the "dose of infection" was calculated by multiplying the crescent-rate (percentage of carriers of gametocytes of *P. falciparum*) by the mean catch of *A. culicifacies* for each of the months July, August and September, and taking the mean of the products. It is determined more by the crescent-rate for September than by the catch of mosquitos, for the incidence of malaria was low in 1934 and the catch of mosquitos was not, but the September crescent-rate was only 3·6 and was chiefly responsible for the low figure for the dose of infection. A low crescent-rate in September is believed to be due to defective transmission in July and August, and so may be fairly included as a factor in estimating the dose of infection. It is shown that the dose of infection varies directly with the number of new cases of malignant tertian and the incidence of malaria in general. It is concluded that fluctuations in the malaria of the Karnal district are almost entirely due to fluctuations in the dose of infection and that this dose of infection is determined chiefly by the length of the period of low saturation deficiency. The latter depends rather on an even distribution of rainfall than on the total amount of rain.

SENIOR WHITE (R.). **On Malaria Transmission in the Jeypore Hills. Part I. A Year's Dissection Results.**—*Rec. Malar. Surv. India* **7** no. 1 pp. 47–75, 18 refs. Calcutta, March 1937.

When the Raipur-Vizianagram Railway was constructed through the intensely malarious Jeypore Hills, no Anopheline dissections were

carried out and malaria control was achieved by directing measures against all species that had been proved to be vectors in some part of Asia, or were closely allied to a proved vector [*cf. R.A.E.*, B **16** 188]. Control measures against the larvae have been continued uninterruptedly, and their efficacy is tested by routine catches of adults; the information in this paper was obtained from the mass of data that had accumulated. The following is a revised list [*cf.* **3** 41; **16** 188] of the species found in the area: *Anopheles subpictus*, Grassi, *A. vagus*, Dön., *A. culicifacies*, Giles, *A. fluviatilis*, James, *A. varuna*, Iyen., *A. minimus*, Theo., *A. jeyporiensis*, James, *A. aconitus*, Dön., *A. aitkeni*, James, *A. hyrcanus* var. *nigerrimus*, Giles, *A. barbirostris*, Wulp, *A. moghulensis*, Chr., *A. maculatus*, Theo., *A. theobaldi*, Giles, *A. karwari*, James, *A. majidi*, Young & Majid, *A. stephensi*, List., *A. splendidus*, Koidz., *A. tessellatus*, Theo., *A. jamesi*, Theo., *A. annularis*, Wulp, *A. philippinensis*, Ludl., and *A. pallidus*, Theo. The first seven are the most abundant, but, from the numerous larvae of *A. maculatus* and *A. theobaldi* found in suitable streams and seepages, it would appear that these two species are more numerous than the records of the adults suggest. As an impression had been formed that *A. culicifacies* was a less efficient vector in this region than the group of species comprising *A. fluviatilis*, *A. varuna* and *A. minimus*, dissections were made during 1935–36 of Anophelines collected in villages practically unaffected by control measures that were situated near the most malarious section of the railway at an altitude of 1,000 ft. A total of 6,944 mosquitos belonging to 12 species were dissected; oöcysts were found in *A. fluviatilis* (80 out of 1,111), *A. varuna* (26 out of 317), *A. minimus* (17 out of 201), *A. culicifacies* (3 out of 4,744), *A. jeyporiensis* (4 out of 318), and *A. aconitus* (1 out of 107), but sporozoites were seen only in the first three, the numbers infected being 40, 15 and 8, respectively. The infection rates in these three species are similar and no differences have been discovered in their breeding places, so that for practical purposes they may be treated as one. *A. culicifacies*, which is the most abundant species, obviously plays no part in the transmission of malaria. Possible explanations are discussed and some evidence is brought forward indicating that this species may be of no pathogenic importance over a wide tract of east-central India. The gut infection in *A. aconitus* is believed to be the first discovered west of Burma, and only two examples of *A. jeyporiensis* have previously been found infected [*cf.* **23** 17]. Where irrigation is perennial, infection is present throughout the year; in other places, no transmission takes place from March to July, inclusive.

Covell (G.) & Afridi (M. K.). **Experimental Application of Paris Green from Aircraft.**—*Rec. Malar. Surv. India* **7** no. 1 pp. 93–103, 1 pl., 2 figs., 2 diagr. Calcutta, March 1937.

A detailed account is given of preliminary experiments in 1936 on the distribution of Paris green by aeroplane for the control of Anopheline larvae, designed to test the efficiency of the apparatus and the suitability of powdered soapstone as a carrier. It became obvious in the course of the work that the part of the Delhi area for which this method of control had been suggested could be dealt with more satisfactorily and at less expense in other ways, so that dusting by this means was not actually used as part of the anti-malaria campaign. Soapstone

proved to be a very suitable carrier and a high proportion of the larvae were killed, but the method has several disadvantages. Great skill is required on the part of the pilot, who has to fly very low in order to get the best results. An extended series of experiments is necessary to determine the best technique for a given area, and although a large amount of ground can be covered in a short time when the technique is perfected, the method cannot be applied in a new area at short notice. There is always a risk that certain parts of the area may be insufficiently dusted on account of sudden changes in the direction and velocity of the wind. Unless an aeroplane and the services of a pilot can be obtained free, the cost is greater than that of applying larvicides by hand. The cost in any particular locality varies considerably, depending largely on the distance between the breeding places and the aerodrome to which the pilot must return at intervals to re-fill the hopper. It is concluded that the application of Paris green by aircraft is only justified where the breeding area is very extensive, where it is essential to control larvae regularly over an extended period, and where it is impossible to apply with success any other method of control. It is not considered likely to prove of practical value in India under present circumstances. Details of the construction of the apparatus fixed to the aeroplane for the distribution of the dust are given in an appendix.

Papers noticed by Title only.

[Kostić] Kostitch (D.). *Anopheles* **Mosquitoes in Yugoslavia and their Zoophilism.**—*Ann. trop. Med. Parasit.* **31** no. 1 pp. 15–22, 15 refs. Liverpool, 8th April 1937. [*Cf. R.A.E.*, B **25** 67.]

Patton (W. S.). **Studies on the Higher Diptera of Medical and Veterinary Importance. The Bot Flies of the Subfamily Oestrinae** [including a list of the species with their hosts and notes on the terminalia of some of them].—*Ann. trop. Med. Parasit.* **31** no. 1 pp. 113–125, 10 figs., 3 refs. Liverpool, 8th April 1937. [*Cf. R.A.E.*, B **25** 104.]

Patton (W. S.). **Studies on the Higher Diptera of Medical and Veterinary Importance. A Revision of the Species of the Genus** *Musca*, **based on a Comparative Study of the Male Terminalia. IV. A practical Guide to the Oriental Species.**—*Ann. trop. Med. Parasit.* **31** no. 1 pp. 127–140, 8 figs., 6 refs. Liverpool, 8th April 1937. [*Cf. R.A.E.*, B **25** 128; **13** 46.]

Philip (C. B.). **Notes on certain Males of North American Horseflies (Tabanidae). II. The** *affinis* **or " red-sided " Group of** *Tabanus sens. lat.* **with a Key to the Females.**—*Canad. Ent.* **69** nos. 2–3 pp. 35–40, 49–58, 11 refs. Orillia, Ont., February–March 1937.

Macfie (J. W. S.). **Ceratopogonidae (Diptera) from Ethiopa and British Somaliland.**—*Proc. R. ent. Soc. Lond.* (B) **6** pt. 4 pp. 73–78, 3 figs. London, 15th April 1937.

Schulze (P.). **Eine afrikanische Zecke** (*Haemaphysalis leachi* **Aud.**) **auf einem mecklenburgischen Storch.** [An African Tick, *H. leachi*, on a Stork in Mecklenburg.]—*Arch. Ver. Naturg. Mecklenb.* N.F. **11** (1936) p. 73. Güstrow, 1937.

Majid (S. A.). **An improved Technique for marking and catching Mosquitoes.**—*Rec. Malar. Surv. India* **7** no. 1 pp. 105–107, 1 pl., 1 fig. Calcutta, March 1937.

The author describes a technique for marking mosquitos in which there is no need to kill those that are recaptured in order to identify them. Mosquitos are immobilised in a test-tube by exposure for not more than 3 seconds to a drop of chloroform or ether on the cotton-wool plug, identified and placed in a suitable cage to recover, which they usually do in about 20 minutes. They are then dusted by means of a pump, which is described, with a marking powder, known as "gold" powder, commonly used in printing works. The powder is light and inert, and, as it does not adhere to the wings, it does not presumably interfere with their flight. Moreover, it is cheap and available in a number of colours. Sufficient powder to cover the thorax and abdomen is all that is necessary, and, although the mosquito endeavours to remove the dust, enough always remains for identification. This may be carried out by lightly chloroforming the mosquitos caught and examining them on a watch glass under a binocular dissecting microscope. The dusted ones are readily distinguished by the conspicuous metallic lustre of the particles of powder. The mosquitos soon recover and can again be used for experimental purposes.

In the second part of the paper, the author describes and illustrates an apparatus for catching mosquitos in which they are drawn by suction into a test tube.

Wats (R. C.) & Singh (J.). **An Investigation into the Mosquitocidal Value of indigenous Derris and other Drugs.**—*Rec. Malar. Surv. India* **7** no. 1 pp. 109–114, 7 refs. Calcutta, March 1937.

Experiments were carried out with a view to evolving a spray for use against mosquitos in huts that could be prepared locally from accessible ingredients sufficiently cheap to be within the means of an Indian villager. Tests were made of various vegetable oils, plant substances extracted with different solvents, and certain chemicals dissolved in kerosene, using the technique already described [*R.A.E.*, B **23** 300], but the results showed that the 65 materials tested (a list of which is given) were all much less effective than pyrethrum extract in kerosene [*loc. cit.*].

Corradetti (A.). **Sui caratteri morfologici degli ibridi derivati dall' incrocio tra** *Anopheles maculipennis* **var.** *elutus* **e** *Anopheles maculipennis* **var.** *atroparvus*. [On the morphological Characters of the Hybrids from Crosses of *A. sacharovi* and *A. maculipennis* var. *atroparvus*.]—*Riv. Malariol.* **16** (1) no. 1 pp. 42–45, 5 refs. Rome, 1937. (With a Summary in English.)

From 600 females of *Anopheles sacharovi*, Favr (*maculipennis* var. *elutus*, Edw.) and a nearly equal number of males of *A. maculipennis* var. *atroparvus*, van Thiel, placed in four cages measuring about 22 × 16 × 10 ins., only 12 batches of fertilised eggs were obtained, though the females had opportunity daily for feeding on guineapigs and many showed signs of egg-maturation. This reduced egg-production was not due to the season, as the experiments were made in Italy in August and in the first half of September at a temperature varying from 18 to 25°C. [64·4 to 77°F.]. As in previous experiments [*R.A.E.*, B **23** 115], the eggs were identical with those of *A. sacharovi.*

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Only about 100 of the fertilised eggs produced larvae, and though kept under favourable conditions, most of the larvae died, only 9 reaching the fourth instar. Of these, 6 pupated and 5, all males, became adult. These adults had some morphological characters of each of the parents. Their testes were atrophied and contained no spermatozoa.

Tilli (P.). **La disinfestione calciocianamidica. Considerazioni generali igieniche e economiche.** [Disinfestation with Calcium Cyanamide. General hygienic and economic Considerations.]—*Riv. Malariol.* **16** (1) no. 1 pp. 54–59, 2 pls., 1 diagr. Rome, 1937. (With a Summary in French.)

In 1936, calcium cyanamide was used with success on an extensive scale in the district of Rome against eggs, larvae and pupae of Anophelines and other mosquitos. In addition to killing them, it also causes changes in the general aquatic fauna and flora [*cf. R.A.E.*, B **23** 204] and thus renders the water unfavourable for the further breeding of mosquitos.

Craig (W. J. F.). **Anti-malaria Drainage Work in the new Changi Cantonment.**—*J. R. Army med. Cps* **68** nos. 1–2 pp. 15–26, 73–85, 9 figs. London, January–February 1937.

A detailed account is given of the anti-malaria drainage work carried out during the last few years in the area that is being occupied by the new military cantonment of Changi, which is situated at the eastern end of Singapore Island and includes part of the Island of Tekong and a tongue of land in Johore. The Anopheline larvae most commonly found in the area, in order of frequency, were *Anopheles hyrcanus* var. *sinensis*, Wied., *A. kochi*, Dön., *A. maculatus*, Theo., *A. sundaicus*, Rdnw., *A. umbrosus*, Theo., *A. vagus*, Dön., and *A. karwari*, James. Larvae of *A. baezai*, Gater, and a variety of *A. umbrosus*, both of which were obtained in brackish water at the edge of tidal swamps, were uncommon. *A. maculatus* and *A. sundaicus* are considered to be the most dangerous vectors of malaria, and measures are being especially directed to waters in which they breed.

The cost of drainage work has been heavy; from the beginning of 1934 to the present time, it has been over £14,000 for open and underground drains, amounting to a total of 14 miles, and not more than two-thirds of the six square miles owned by the War Department has as yet been affected. The expense, however, has already been justified to a certain extent by the results on the Island of Tekong; malaria was prevalent before drainage was begun, but no cases have occurred since it was completed. Malaria is endemic in the native population, and consequently the risk of an outbreak is always present. The main argument in favour of drainage as compared with oiling is its permanency; drains laid 7 years ago are still functioning satisfactorily, and in one locality work done in 1915 is still effective.

Elsbach (E. M.). **Orienteerend malaria- en filaria-onderzoek in Nieuw-Guinea.** [An exploratory Investigation in New Guinea on Malaria and Filariasis.]—*Geneesk. Tijdschr. Ned.-Ind.* **77** no. 17 pp. 1036–1054, 1 pl., 1 map. Batavia, 27th April 1937.

A brief survey in the coastal region around the Lower Digoel and Lower Mappi rivers in Netherlands New Guinea showed that

malaria and filariasis due to *Filaria bancrofti* are endemic, though not severe. The mosquitos found were *Anopheles punctulatus*, Dön., *A. punctulatus* var. *moluccensis*, Sw. & Sw., and *A. bancrofti*, Giles, but they were scarce. Opportunities for breeding are unfavourable in the dry season, and malaria is probably definitely seasonal.

BONNE-WEPSTER (J.). **Een nieuwe gastheerplant voor de larve van** *Mansonia* (*Mansonioides*) *uniformis* **Theo.** [A new Host Plant for the Larva of *M. uniformis*.]—*Geneesk. Tijdschr. Ned.-Ind.* **77** no. 17 pp. 1055–1056, 1 pl., 4 refs. Batavia, 27th April 1937.

Rodenwaldt's experiments in Java indicated that *Pistia stratiotes* is the plant, or one of the plants, to which the larvae of *Mansonia annulifera*, Theo., and *M. indiana*, Edw., attach themselves [*R.A.E.*, B **22** 105], though *M. indiana* has been found on water hyacinth (*Eichhornia crassipes*) in Indo-China [**25** 26]. The author has found larvae of *M. uniformis*, Theo., on *E. crassipes* in Java and those of *M. annulifera* on *P. stratiotes* in the same stretches of water.

CHUNG (Huei-lan). **Chilling as an effective Means of Delousing.**—*Proc. Soc. exp. Biol. Med.* **36** no. 3 pp. 324–326, 7 refs. New York, April 1937.

Epidemics of typhus and relapsing fever transmitted by body lice [*Pediculus humanus*, L.] often occur in northern China under conditions that render it impossible to use heat treatment on a large scale to free clothing from lice. In November–February, however, the temperature ranges from −16°C. [3·2°F.] to −40°C. [−40°F.], and experiments were therefore carried out to test the possibility of destroying lice and their eggs by exposure to cold. Altogether 2,922 lice of both sexes from 4 to 32 days old, divided into 40 lots, and 2,370 eggs in 9 lots were subjected to temperatures ranging from −1°C. [30·2°F.] to −25°C. [−13°F.] for various periods. Many thousands of lice and eggs were also subjected to temperatures from 5°C. [41°F.] to 8°C. [46·4°F.] for many days. The method employed in the investigations is described, and the results are summarised. All lice exposed out-of-doors were killed in 9 or 13 hours at temperatures ranging from −10°C. [14°F.] to −14°C. [6·8°F.] or −12°C. [10·4°F.], respectively. They were killed in a refrigerator in 2 hours at −17°C. [1·4°F.] or in 1 hour at −25°C.; all eggs were killed in 2 hours at each of these temperatures. Exposure for 3 hours at −17°C. or for 2½ hours at −25°C. was required to kill lice protected by a layer of cotton-wool that was 0·5 cm. thick when compressed. When fed once daily, many lice survived a temperature of 5–8°C. for 6–8 weeks. Exposure to about −7°C. [19·4°F.] for 36 hours or about −10°C. [14°F.] for 10 hours was not fatal. Exposure to 5°C. for 7 days or longer prevented most of the eggs from hatching. It is concluded that a refrigerator might be used to destroy lice and eggs in valuable furs and other garments that would be damaged by moist or dry heat.

FENG (Lan-chou) & CHUNG (Huei-lan). **Attempts to infect** *Ornithodorus moubata* **with the Chinese Strain of** *Spirochaeta recurrentis*.—*Proc. Soc. exp. Biol. Med.* **36** no. 3 pp. 330–333, 6 refs. New York, April 1937.

An account is given of experiments in which larvae and adults of *Ornithodorus moubata*, Murr., were fed on squirrels infected with the

Chinese strain of *Spirochaeta recurrentis*, which is transmitted by *Pediculus humanus*, L. [*cf. R.A.E.*, B **25** 98]. After feeding, the ticks were kept at 25–28°C. [77–82·4°F.]. Dissection showed that the spirochaetes penetrated the stomach wall and reached the body cavity in some of the ticks during the first 4 days of infection. No spirochaetes survived, however, after the 4th day, and even dead ones could not be found after the 5th day. None was found in other organs (salivary glands, malphighan tubes, etc.). Four susceptible squirrels on which batches of ticks were fed 4–116 days after they had fed on infected squirrels did not become infected, and injection of suspensions of some of the same ticks also gave negative results.

[MUFEL' (P. P.) & NEMIROVSKAYA (A. I.).] **Муфель (П. П.) и Немировская (А. И.). Le rôle des étangs de pisciculture dans l'épidémiologie du paludisme.** [*In Russian.*]—*Med. Parasitol.* **5** no. 5 pp. 753–757, 1 ref. Moscow, 1936. (With a Summary in French.)

A survey in the summer of 1935 of the fish-ponds in the central part of the Province of Voronezh, where the incidence of malaria has considerably increased in recent years, showed that mosquito larvae occur in all types of ponds because they have not been kept in good condition. The larvae are particularly numerous where ends of the ponds are shallow or have formed swamps, and are protected from the fish by dense aquatic vegetation.

[MOSHKOVSKIĬ (Sh. D.), NOSINA (V. D.) & LATUISHEV (N. I.).] **Мошковский (Ш. Д.), Носина (В. Д.) и Латышев (Н. И.). Some Data on *Phlebotomus papatasii*.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 pp. 850–851, refs. pp. 890–891. Moscow, 1936.

In the course of investigations in Sebastopol in 1932–33, no eggs or larvae of *Phlebotomus* were found in the litter from henhouses, pigsties and outhouses, or in refuse or soil taken from orchards or near latrines. Experiments in which a 10 per cent. solution of calcium chloride was poured over fourth-instar larvae of *P. papatasii*, Scop., placed on filter paper on rather damp sand and covered with a few dry leaves showed that effective control could be obtained only if the solution was used at the rate of not less than 1 gal. per sq. yard. Sandfly fever was not transmitted to man by repeated feeding of females of *P. papatasii* reared from eggs laid by sandflies captured at the height of an epidemic [*cf. R.A.E.*, B **11** 61], or by injections of suspensions of male sandflies reared from the same batch of eggs or taken in an epidemic focus.

[VOINOV (I. I.), SEMIKOZ (F. F.) & CHEBOTAREVICH (N. D.).] **Воинов (И. И.), Семикоз (Ф. Ф.) и Чеботаревич (Н. Д.). Fièvre pappataci au Caucase du Nord.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 pp. 852–862, 5 graphs, refs. pp. 890–891. Moscow, 1936. (With a Summary in French.)

[SERGIEV (P. G.). **Сергиев (П. Г.). Au sujet de la fièvre pappataci au Caucase du Nord.** [*In Russian.*]—*T.c.* pp. 863–869, refs. pp. 890–891. (With a Summary in French.)

In the first paper an account is given of a severe epidemic of a disease that occurred in late July and the first half of August 1935 in the town

of Georgievsk in the south-east of North Caucasus. It was at first thought to be malaria, but clinical study led to the conclusion that it was sandfly fever, and this view was supported by the capture in August of a single female of *Phlebotomus papatasii*, Scop., the only known vector. Reference is made to previous records of sandflies in the northern Caucasus [*R.A.E.*, B **18** 37, 254; **23** 113]. The rather dry conditions that prevailed in the summer of 1935 and the high temperature in the second half of July, which averaged 19·1°C. [66·38°F.], favoured the outbreak of the disease, since Whittingham found that sandflies can infect man at 18·5°C. [65·3°F.], but not at lower temperatures.

In the second paper is recorded the occurrence of several cases of sandfly fever in the town of Armavir in the central part of North Caucasus between the years 1929 and 1932 and the capture there of a single female of *P. major*, Annan. [**23** 113], which indicates that other sandflies, including *P. papatasii*, may also occur. The author compares the records of outbreaks of the disease in North Caucasus with data on the occurrence of sandflies there and concludes that it has long been present but has been confused with malaria.

[LATUISHEV (N. I.) & SOCHILOVA (A. A.).] **Латышев (Н. И.) и Сочилова (А. А.). A la recherche d'une solution au problème des phlébotomes. III. Essai d'identifier le sang de l'intestin des phlébotomes dans un foyer épidémique de fièvre des pappataci.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 pp. 879–884, refs. pp. 890–891. Moscow, 1936. (With a Summary in French.)

In the course of investigations on the epidemiology of the sandfly fever in Stalinabad (western Tadzhikistan) in the summer of 1935, precipitin tests were carried out to identify the blood in the stomachs of 551 engorged females of *Phlebotomus papatasii*, Scop., taken chiefly in inhabited buildings in a village in which the disease is endemic. Positive results were obtained with 67·5 per cent. of the sandflies, most of which contained only one kind of blood. About 25 per cent. had fed on pigs, 20 per cent. on man and the others on fowls, dogs, cows, horses, sheep or rats. None contained the blood of bats (*Pipistrellus*). The evidence obtained suggested, however, that the sandflies have no particular preference for man or any one of the animals on which they had fed, any apparent preference being explained by the numbers and accessibility of the hosts concerned.

[LATUISHEV (N. I.).] **Латышев (Н. И.). Some Attempts to solve the Sandfly Problem. IV. An Attempt to determine the Range of Flight of Sandflies.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 pp. 885–889, 1 diagr, refs. pp. 890–891. Moscow, 1936.

Experiments in Sebastopol to ascertain the range of flight of sandflies [*Phlebotomus papatasii*, Scop.] were continued on a larger scale [*cf.* *R.A.E.*, B **22** 79] in 1936. Over 3,500 sandflies of both sexes caught at the end of August were stained and liberated on the following day on a sloping plateau with a ravine and hardly any vegetation. There were several inhabited houses at distances varying from 550 to 1,300 yards. Only 13 stained sandflies could be caught in these houses during the next few days; 5 females and 1 male had travelled for 550 yards and 4 females and 3 males for 770. These last, however,

may have been carried part of the way by cattle, as a herd was moving along the road towards the houses when they were being released.

Medical officers state that no sandflies have been found on ships anchored 220 yards or more from the shore, and that cases of sandfly fever occur only in sailors who have slept on land. This indicates that the sandflies are not capable of sustained flight without alighting.

[SHCHURENKOVA (A. I.).] **Щуренкова (А. И.). Nouvelle espèce de phlébotome** – *keshishiani* **sp. nov.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 pp. 892–899, 5 figs. Moscow, 1936. (With a Summary in French.)

A detailed description is given of the male external genitalia, the spermathecae of the females and the pharynx of both sexes of *Phlebotomus keshishiani*, sp. n., a sandfly of the *perniciosus* group which was found in the Pamir mountains in south-eastern Tadzhikistan in July 1936 at altitudes of 6,000–7,600 ft. Examples were caught in inhabited buildings, animal quarters and in a cleft in a rock 330 yards from dwellings, and occurred in one village in stables together with *P. chinensis*, Newst., which was abundant.

[DANILOVA (M. I.).] **Данилова (М. И.). Sur l'écologie des anophèles ailées** *maculipennis messeae* **Fall. et** *atroparvus* **v. Thiel dans la région de Starominsk dans le Gouvernement Azov-Mer Noire.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 pp. 927–936, 5 graphs, 6 refs. Moscow, 1936. (With a Summary in French.)

In the course of observations on *Anopheles maculipennis*, Mg., in the west of the northern Caucasus in 1935 [*R.A.E.*, B **24** 266], it was found that race *atroparvus*, van Thiel, bred in a river that became partly dry and contained brackish water towards the end of the summer [*cf.* **22** 36]. Adults of races *messeae*, Flni., and *atroparvus* were very abundant during the day in animal quarters and to a less extent in occupied houses. Uninhabited buildings, latrines and the dark entrances to houses, with a relative humidity of 62–78 per cent. and a temperature of 25–27°C. [77–80·6°F.], were also used as shelters for one or several days. Of 4,113 females dissected, 8 contained oöcysts of malaria parasites. Females with mature eggs regularly decreased in numbers from the beginning of August and disappeared at the beginning of October, whereas individuals with immature eggs and apparently in the state of gonotrophic dissociation [**18** 53] became more abundant. At the same time, mosquitos with a developed fat-body, which first appeared in the second half of July, gradually became more numerous and constituted 99–100 per cent. of the population early in October. Measurements of the oviducts [*cf.* **21** 71] showed that the number of young females began to increase rapidly about mid-August ; they had almost supplanted the old mosquitos by early October. The number of mosquitos in day-time shelters sharply decreased in the second half of August as race *messeae* began to enter hibernation, probably in uninhabited quarters ; but rose again in September, as *atroparvus* congregated in day-time shelters, chiefly animal quarters, where it remained throughout the winter in an active state and feeding. Considerable numbers of males were found among hibernating females in October, and some had a developed fat-body. Females with partly developed ovaries were found in the second half of January and about mid-February ;

a large number contained mature eggs in the second half of March, and 10–12 batches of eggs (all of race *atroparvus*) were laid in the laboratory.

[SHIPOVA (A. A.).] **Шипова (А. А.). Durée du vol des anophèles du moment de l'hibernage.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 pp. 937–941, 1 map. Moscow, 1936. (With a Summary in French.)

In view of the fact that *Anopheles maculipennis*, Mg., breeds in large numbers in extensive swamps and water-meadows near the town of Tomsk (western Siberia), experiments to ascertain its range were carried out by releasing stained mosquitos on each bank of the river Tom at a distance of 2½ miles from the town, a total of 1,253 being liberated on 19th and 20th October 1935, when the temperature was about 3°C. [37·4°F.] Of 1,805 mosquitos collected in November-January in hibernation quarters in and near Tomsk, 52 were stained. Some of these were taken at points about 2, 6, 9 and 11 miles from the place of release ; it was evident from local conditions that they had flown for about 2 miles, but might have been carried over the longer distances on boats, carts, etc.

Of 1,799 mosquitos dissected, 0·1 per cent. had malaria sporozoites in the salivary glands, and 0·05 per cent. had oöcysts on the stomach.

[POKROVSKIĬ (S. V.) & MURATOVA (A. P.).] **Покровский (С. В.) и Муратова (А. П.). Matériaux pour l'étude des variétés de *A. maculipennis* Meig. des régions de Moscou et de Kalinine.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 pp. 942–949. Moscow, 1936. (With a Summary in French.)

Examination of 389 batches of eggs laid in the laboratory by females of *Anopheles maculipennis*, Mg., taken in 1935 in various districts in the provinces of Moscow and Kalinin showed that 73·3 per cent. of the mosquitos belonged to race *messeae*, Flni., and the remainder to race *maculipennis* (*typicus*). The distribution of these races in the two Provinces is given in a table based on the examination of 806 batches of eggs obtained in the laboratory during 1933–35. In most localities, the two races occurred together, with a marked prevalence of *messeae*. Race *maculipennis* predominated only in the extreme west of Kalinin Province, and *messeae* occurred alone in a district east of Moscow. Of the females of *messeae* taken in day-time shelters in summer, 72·6 per cent. occurred in animal quarters, 19·9 per cent. in inhabited houses and 7·5 per cent. in latrines, the corresponding percentages for race *maculipennis* being 86·8, 4·4 and 8·8. Counts of the numbers of batches of eggs deposited showed that *maculipennis* is more prolific than *messeae* in June–August and less so in winter, its fecundity declining sharply in September.

[LATUISHEV (N. I.).] **Латышев (Н. И.). Indications téchniques pour la récolte des phlébotomes.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 pp. 950–955, 1 fig., 11 refs. Moscow, 1936.

An account is given of methods of collecting, dissecting and preparing specimens of sandflies (*Phlebotomus*), of marking living sandflies for release and recapture, and of examining samples of soil, etc., for the presence of the larvae.

[KREMER (B. I.) & KUVICHINSKIĬ (—).] **Кремер (Б. И.) и Кувичинский (—). Nouvelle méthode de lutte contre les moustiques ailés.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 pp. 955–956. Moscow, 1936. (With a Summary in French.)

It is stated that a carefully mixed dust of anabasine sulphate and finely ground slaked lime, called " Imagocide " and containing 5–10 per cent. anabasine, has proved effective in destroying mosquitos in houses, sheds, etc. It keeps well in corked bottles and is applied with a hand duster ; contact with the smallest particle paralyses and kills a mosquito in 1–2 minutes.

[OLENEV (N. O.).] **Оленев (Н. О.). Notes sur la parasitologie en Carélie.** [*In Russian.*]—*Med. Parasitol.* **5** no. 6 p. 957. Moscow, 1936.

A brief record is given of observations carried out in southern Karelia in 1935–36. Active overwintered females of *Anopheles maculipennis*, Mg., were found in buildings on 22nd-25th April. Most of the cases of malaria occur in June–August, and only a few in November–March. *Aëdes vexans*, Mg., and *A. punctor*, Kby., were observed in pastures in October. Flies that caused annoyance to cattle and horses included *Morellia*, *Hydrotaea irritans*, Fall., *Haematobia stimulans*, Mg., *Stomoxys calcitrans*, L., *Musca domestica*, L., *M. tempestiva*, Fall., *M. autumnalis*, DeG., and *Simulium ornatum*, Mg. Larvae of *Hypoderma bovis*, DeG., were found in cattle 4–7 years old, but only a few were heavily infested. Of the Ixodid ticks, *Ixodes persulcatus*, Schulze, occurred furthest north, *I. ricinus*, L., was chiefly present on the south-western shore of Lake Onega, and *I. areololaris*, sp. n. (characterised solely by the fact that the female has only one porose area) was found still further south.

OBITZ (K.). **The Abundance and Distribution of the Cattle Grubs** (*Hypoderma* **sp.**) **in Poland.** [*In Polish.*]—*Mém. Inst. polon. Écon. rur.* **16** (1935) fasc. 1 pp. 223–233, 1 graph, 5 fldg maps, 8 refs. Pulawy, 1936. (With a Summary in English.)

Investigations on the distribution of warble-flies (*Hypoderma*) in Poland [*R.A.E.*, B **23** 170] were continued in 1935, and the results are discussed on the basis of reports received from various parts of the country. In 21 districts out of 239, the rate of infestation of cattle was less than 1 per cent., and in the remaining 218 it varied from 1 to 71 per cent. Infestation is more frequent in the northern and north-eastern parts of Poland, and the flies are most numerous in wooded areas. The larvae are found under the skin of the animals from the end of February to the end of August ; they were generally most abundant in June, though in the north (Toruń) and north-east and near Krakow, where *Hypoderma lineatum*, Vill., occurs together with *H. bovis*, DeG., most of the larvae emerged from the backs of the cattle in May. In the mountains and in districts along the middle Vistula, cattle were much less severely infested than in 1934, because many of the pupae had been destroyed in that year by the heavy rains and floods that occurred during the summer.

Roubaud (E.), Colas-Belcour (J.) & Stefanopoulo (G. J.). **Transmission de la fièvre jaune par un moustique paléarctique répandu dans la région parisienne, l'*Aëdes geniculatus* Oliv.**—*C. R. Acad. Sci. Fr.* **205** no. 2 pp. 182–183. Paris, 1937.

Aëdes (*Finlaya*) *geniculatus*, Ol., which breeds in tree-holes and feeds readily on man and animals in warm weather, occurs in forests in temperate regions of Europe and has exceptionally been recorded also from Asia Minor and Algeria. To test the possibility of its being able to transmit yellow fever, a few newly emerged females, reared from larvae collected in Normandy, were allowed to feed on 27th May on a monkey, *Macacus rhesus*, infected with a strain of the virus that had been maintained in monkeys for 10 years. The 8 mosquitos that engorged were kept at 30–35°C. [86–95°F.] and fed on slightly sweetened water. On 10th, 14th and 17th June, some of them were fed on another monkey. This animal became ill 5 days after the first bites, or 48 hours after the second, and died of yellow fever on 23rd June. On 18th June, suspensions of the mosquitos were inoculated into 8 mice, which died of yellow fever after the usual interval.

Mosna (E.). **Sulle caratteristiche termiche dei focolai di *Anopheles maculipennis*.** [On the thermal characteristics of the Breeding Places of *A. maculipennis*.]—*Riv. Parassit.* **1** no. 2 pp. 139–155, 1 fig., 1 graph, 9 refs. Rome, April 1937. (With Summaries in French, English and German.)

Missiroli observed in Italy that one of the more important features of breeding places of *Anopheles maculipennis*, Mg., race *labranchiae*, Flni., and *A. plumbeus*, Steph. (here treated as a race of *maculipennis*) was probably the daily variation in temperature [*R.A.E.*, B **24** 112]. In a series of laboratory experiments, the author investigated the effect of constant and alternating temperatures on the speed of development and vitality of *A. maculipennis*, races *labranchiae* and *atroparvus*, van Thiel, using terracotta pans, about 11 ins. in diameter and 3 ins. deep, at temperatures controlled by a thermostat. The constant temperatures used were 20°C. [68°F.], 25°C. [77°F.], 30°C. [86°F.] and 35°C. [95°F.] and the alternating temperatures (obtained by allowing the temperature to fall gradually in the afternoon and raising it rapidly about 8 a.m.) were 15–25°C. [59–77°F.], 20–30°C. and 20–35°C. Batches of 50 newly hatched larvae were used at each temperature.

In the case of *labranchiae* at constant temperatures, the numbers of larvae and pupae that died, and the time in days required for development to the adult stage (which did not occur at 35°C.) were, respectively: 0, 2 and 17–19 at 20°C.; 0, 0 and 12–13 at 25°; 0, 0 and 10–12 at 30°; and 11 and 39 at 35°. The corresponding figures for *atroparvus* were: 0, 0 and 17–19 at 20°C.; 0, 0 and 10–12 at 25°; 7, 2 and 9–10 at 30°; and 50 and 0 at 35°. With alternating temperatures the figures were: 0, 0 and 15–17 at 15–25°C., 0, 0 and 13–15 at 20–30°, and 0, 1 and 11–12 at 20–35° for *labranchiae*; and 3, 0 and 14–16, 0, 0 and 11–13, and 39, 6 and 10, respectively, for *atroparvus*.

From the mortality observed, it is clear that in both races the early instars are the most resistant to unfavourable temperatures. The range in the daily oscillation of temperature in different thermal zones may explain not only the different seasonal distribution, but also the geographical distribution of these races of *A. maculipennis*.

BUONOMINI (G.) & GORI (D.). **Anofelismo e malaria in alcune zone della provincia di Siena.** [Anophelism and Malaria in some Districts of the Province of Siena.]—*Riv. Malariol.* **16** (1) no. 2 pp. 142–159, 4 maps, 16 refs. Rome, 1937. (With a Summary in German.)

The Anopheline fauna was studied in four districts in Siena, two of them free from malaria, one with sporadic cases, and one in which the disease was mildly endemic. *Anopheles claviger*, Mg., and two zoophilous races of *A. maculipennis*, Mg., *viz. maculipennis* (*typicus*) and *atroparvus*, van Thiel, occurred in all four districts, and were the only forms in those free from malaria. *A. superpictus*, Grassi, was found in the district with sporadic cases and is considered responsible for them. All these Anophelines were present in the district where malaria was endemic, together with *A. maculipennis* races *messeae*, Flni., and *labranchiae*, Flni., the last-named being probably the vector, as it is considered to be one of the chief vectors in Italy. The presence of *atroparvus* in the province of Siena is believed to be connected with the deposits of lignite in the subsoil, the breeding places having the turbid water favoured by this race in Italy. *A. superpictus* occurs where fresh, limpid mountain streams with stony beds provide suitable breeding places for it. The various Anophelines were generally associated with stabled cattle, which were abundant in the whole region, and it was only rarely that adults were captured in dwelling-houses.

GIOSEFFI (M.). **La difesa antimalarica di Carpano-Arsa.** [Anti-malaria Work in the Carpano-Arsa Zone.]—*Riv. Malariol.* **16** (1) no. 2 pp. 160–171, 3 figs., 1 map. Rome, 1937. (With a Summary in French.)

In a mining area of Istria named after the river Arsa the incidence of malaria has been reduced to 1·5 per mille by means of constant medical measures (quinine prophylaxis and treatment and removal of infected persons), screening, evening destruction of Anophelines in dwellings, and control of Anopheline larvae by drainage, the use of *Gambusia*, dusting with Paris green, and oiling. Anophelines were rare in dwellings in two villages where there were hundreds of stabled animals, while they were constantly found in houses and hutments in another where there were only 34 animals and about 3,000 inhabitants. An examination of 159 batches of eggs showed 16 to belong to *Anopheles maculipennis*, Mg., race *melanoon*, Hackett, 137 (86·1 per cent.) to race *messeae*, Flni., and 6 (3·78 per cent.) to race *maculipennis* (*typicus*). These races are closely associated with domestic animals, but may attack man and maintain a certain degree of endemic malaria if stabled animals are scarce.

LING (L. C.) & YAO (Y. T.). **The Importance of *A. hyrcanus* var. *sinensis* Wied. as a Malaria Carrier in China, based on the Studies of its Blood Meal and Maxillary Teeth Index.**—*Peking nat. Hist. Bull.* **11** pt. 3 pp. 191–198, 23 refs. Peiping, March 1937.

The literature on the infection of *Anopheles hyrcanus* var. *sinensis*, Wied., with malaria parasites in China, which is briefly reviewed, indicates that this mosquito is not such an efficient vector there as it is in other parts of the world. For this reason a study was made of

its maxillary index and its blood meals. During the summer of 1935, 635 examples were collected from various catching stations in Nanking, including bedrooms, stables, pigsties, etc. Precipitin tests were carried out with the sera of man, horse, cattle, sheep and pig, and of the 472 specimens that gave definite reactions, only 2·33 per cent. were positive for human blood. Most of them (83·05 per cent.), from whatever station they were taken, reacted to horse sera, although in a number the reaction was probably due to donkey rather than horse blood. The maxillary indices of these specimens ranged from 12·5 to 20·5, but most of them fell between 15·5 and 18·5, with a mean for the whole series of 16·5. The average maxillary index for the batches of mosquitos that reacted to the five different kinds of serum were calculated, but the differences were too small to be significant. It is concluded that *A. hyrcanus* var. *sinensis* is adapted to feed on domestic animals and prefers animal to human blood. It is suggested that, in rural areas, domestic animals might be used to attract the mosquitos away from man.

HEADLEE (T. J.). **Possibility of Malarial Outbreaks in New Jersey.**—*Circ. N. J. agric. Exp. Sta.* no. 368, 8 pp. New Brunswick, N.J., September 1936. [Recd. 1937.]

The following is largely taken from the author's summary : Statistics show that between 1879 and 1931 the incidence of malaria in New Jersey steadily declined. Trap records for the north-east and coastal areas, which are available for the years 1932 to 1935, show that the vector, *Anopheles quadrimaculatus*, Say, is present throughout these parts of the State, although its numbers are almost negligible in areas where mosquito control work is carried out. In some trapped areas, where no control measures have been undertaken, particularly in towns and cities along the Delaware River, it is present in large numbers, and it has also been shown to occur in areas where no trapping has been done. An outbreak similar to the one that took place in Camden County [*cf. R.A.E.*, B **25** 186] is likely to occur at any point where a large population of *A. quadrimaculatus* exists at a time when gametocyte carriers happen to be residing there ; since it is impossible to control the movement of infected persons, the only practical way of attacking the problem is by eliminating the breeding places of the vector.

Mosquitoes on Airplanes.—*Publ. Hlth. Rep.* **52** no. 14 p. 414. Washington, D.C., 2nd April 1937.

During November 1936, 69 inspections were made of aeroplanes arriving at Miami, Florida, to determine whether mosquitos had been transported from South America. Insects were taken in the course of 24 inspections, and 13 mosquitos, 10 of which were dead, in 7 of the 24. They included *Aëdes sollicitans*, Wlk., and species of *Culex* and *Mansonia*.

HEADLEE (T. J.). **Some Facts underlying the Attraction of Mosquitoes to Sources of Radiant Energy.**—*J. econ. Ent.* **30** no. 2 pp. 309–312, 1 ref. Menasha, Wis., April 1937.

In investigations on the reactions of insects to different sources of radiant energy, many studies have been made on the effect of various

frequencies but few on the effect of different intensities, primarily because the readily available discontinuous sources of radiant energy are not subject to much variation in intensity, and apparatus for the measurement of intensity is comparatively unusual and requires a high degree of skill for its employment. Since apparatus for the measurement of total energy emitted per square centimetre of surface at a measured distance from the source was available, experiments were undertaken to determine the relationship between certain sources of radiant energy known to be attractive to mosquitos and the number of mosquitos caught under identical sets of experimental conditions.

Four New Jersey mosquito traps [*cf. R.A.E.*, B **20** 241] were placed in a row 50 feet apart, and the lead wires were so arranged in length that the voltage delivered to each was essentially the same. The sources of radiant energy were a 25-watt white frosted bulb giving a white light, a tube filled with neon gas giving a red light, a tube filled with mercury vapour stained so as to give a green-yellow light, and a tube filled with mercury argon vapour, unstained, giving a blue light. These lights were used between 22nd June and 15th July. Catches were also made between 16th July and 15th August, using white-frosted bulbs in all the traps, and differences in the catches due solely to the different situations were evaluated by expressing the catches in the last three traps as fractions of the catch in the first trap. By multiplying the numbers of mosquitos actually caught during the first period in the first trap by these fractions, it was possible to find the number of mosquitos that would have been caught during the first period in the other traps had they all been fitted with white-frosted bulbs. The energy received per square centimetre at distances of 10 inches from the four different lights was measured on the apparatus in microwatts. The number of mosquitos caught per microwatt was calculated by dividing the number of mosquitos actually caught in each trap by the number of microwatts received from the light in that trap, and by dividing the theoretical numbers that would have been caught in each by white-frosted bulbs by the number of microwatts received from the white light. By dividing the actual number caught per microwatt by the number that would have been attracted per microwatt by a white lamp, it was found that the red, green-yellow and blue lights were 6·1, 12·3 and 21·5 times as attractive as the white one.

GINSBURG (J. M.). **Studies in reducing Volume of Oil necessary to kill Mosquito Larvae by incorporating Pyrethrum.**—*J. econ. Ent.* **30** no. 2 pp. 328–332, 8 refs. Menasha, Wis., April 1937.

In the field, it is usually necessary to apply oil at the rate of 20 to 50 U.S. gallons to an acre of water surface if a film that will kill mosquito larvae is to be produced. Although by using an emulsion of kerosene containing pyrethrum extract [*cf. R.A.E.*, B **23** 205, etc.] the amount of oil may be reduced to about 3 U.S. gals. per acre, the volume of spray to be transported is not reduced, since about 50 U.S. gals. of the dilute emulsion are usually required to liberate enough oil to form a toxic film. An investigation was therefore undertaken to determine the smallest quantity of pyrethrum that would so increase the toxicity of kerosene that the minimum volume of oil by which it is physically possible uniformly to cover a given area of water would also produce a film toxic to mosquito larvae. From laboratory and field observations,

it is estimated that the physical minimum quantity of kerosene or similar light-petroleum distillates ranges from 3 to 6 U.S. gals. per acre. Laboratory tests were carried out on third and fourth-instar larvae of *Aëdes sollicitans*, Wlk., and *Culex pipiens*, L., with kerosene containing percentages of pyrethrins ranging from 0·01 to 0·1 applied at rates of about 3 and 6 U.S. gals. per acre and with kerosene alone at rates of 3, 6 and 12 U.S. gals. to the acre. Higher rates were not used, since in the laboratory kerosene alone at 12 U.S. gals. to the acre killed 98 and 98 per cent. of *C. pipiens* and 92 and 99 per cent. of *A. sollicitans* in 2 and 24 hours, respectively.

A. sollicitans proved somewhat more resistant to the pyrethrum-kerosene larvicide than *C. pipiens*. With the latter, when the rate of application was 3 U.S. gals. per acre, it required the addition of 0·02 per cent. pyrethrins (about 0·2 lb. flowers to the U.S. gal.) to produce a mortality equal to the control (kerosene alone at 12 U.S. gals.), namely, 98 per cent. in 2 hours and 100 per cent. in 24. At the rate of 6 U.S. gals. per acre the addition of 0·01 per cent. pyrethrins killed all the larvae within 24 hours, but only 94 per cent. in 2 hours. Thus the minimum amount of pyrethrins in this case would appear to be between 0·01 and 0·02 per cent.

With *A. sollicitans*, when the rate was 3 or 6 U.S. gals. per acre, it was necessary in both cases to add 0·08 per cent. pyrethrins to produce complete mortality in 2 hours, and 0·02 and 0·01 per cent., respectively, to produce the same result in 24 hours. The control, however, gave only 92 per cent. mortality in 2 hours, and 96 and 94 per cent. mortality were obtained in the same time by adding 0·04 and 0·02 per cent. pyrethrins, respectively. The author considers that the results from the 2-hour period offer a safer index for determining the minimum concentration of pyrethrins than those from the 24-hour period. Thus under laboratory conditions the volume of oil can be reduced from 12 to 3 U.S. gals. per acre by adding pyrethrins at the rate of 0·01–0·04 per cent.

Gaines (J. C.), Clare (S.) & Richardson (C. H.). **Weight of Adult Housefly and Effect of a sublethal Dose of Sodium Arsenite upon it.**—*J. econ. Ent.* **30** no. 2 pp. 363–366, 1 fig., 3 refs. Menasha, Wis., April 1937.

It was thought that the information obtained in this investigation on the normal distribution of the weights of male and female houseflies (*Musca domestica*, L.) reared on a standard diet would be useful for comparison in subsequent studies on toxicity, etc. The mean weight of 402 males was 18·075 mg. and of 457 females was 27·650. The average deviations were 1·997 and 2·530 mg., and the distributions of the weights of both sexes were almost symmetrical. The weights of the females were more variable, probably because they reflect the somewhat unequal development of the eggs in individual females. Flies that were allowed to feed for 18 hours on sublethal concentrations of sodium arsenite in sucrose solution and were then fed on milk for about 6 days did not differ significantly in weight from normally fed flies, but were distinctly more sluggish.

Doty (A. E.). **Convenient Method of rearing the Stable Fly.**—*J. econ. ent.* **30** no. 2 pp. 367–369, 6 refs. Menasha, Wis., April 1937.

Details are given of a method of rearing *Stomoxys calcitrans*, L., adapted from the method used by Grady for rearing *Musca domestica*,

L. [*cf. R.A.E.*, B **16** 254]. The work was carried out in a small, well-lighted insectary at a temperature of 70–80°F., copper screen cages 18 × 11 × 12 inches being used for breeding and stocking the flies and standard glass battery jars (about 5 inches in diameter by 8 inches high) for the larvae. The artificial medium used for oviposition and larval development was similar to that used by Richardson [**20** 261], but a small quantity of oat hulls (about 1 lb.) was added to prevent it packing too tightly for these larvae. The adults were fed on cow's blood to which sodium citrate had been added to prevent clotting. Each breeding cage contained 50–200 flies and a tin tray, 7 inches in diameter and $\frac{3}{8}$ inch deep, full of the oviposition medium, on which rested a petri dish of blood. The eggs, which were laid round the edge of the tray and under the petri dish, were removed on alternate days by tipping the contents of each tray into a battery jar three-quarters full of freshly-prepared medium, which was then thoroughly stirred. If the food-supply became exhausted or the moisture content too low, the larvae developed very slowly and gave rise to small flies, which in some cases emerged in batches over a period of several weeks, although all the eggs had been laid at about the same time. Adults were transferred by placing the receiving cages in the light in such a position that the flies liberated from the rearing jars were attracted to the rear of the cage. The flies were fed early in the morning and late in the afternoon on citrated blood, which was warmed to 30–35°C. (86–95°F.). The warm blood was poured into the petri dish until it covered the bottom, and a square of absorbent butter muslin was placed in the blood to prevent the flies from drowning. Most of the flies engorged at once, but a few fed later in the day when blood was introduced a second time. Although rearing jars and cages were steamed at intervals, mites became troublesome at times. To keep emerging flies free from them, the medium containing the pupae was washed into a pail of water and the pupae, which floated to the surface, were skimmed off and placed in pupal cages (similar to, but smaller than, those used for adults), without apparently suffering any harmful effects. Under the conditions described, the egg, larval and pupal stages lasted 2–5, 9–15 and 4–14 days, fertile eggs were laid in 7–14 days, and adult flies lived for 2–30 days with a mean of 13.

Tests on both wild and reared flies showed that they were considerably less resistant than *M. domestica* to sprays containing an aliphatic thiocyanate (Lethane 384), pyrethrum or rotenone, and that they are repelled by these sprays to about the same degree as *M. domestica*.

RUATA (G.). **La lotta contro le mosche in Italia.** [Measures against Flies in Italy.]—*Ann. Igiene* **47** no. 4 pp. 180–190. Rome, April 1937.

In health regulations that have been in force in Italy for some ten years, provision is made for the enforcement, where necessary, of measures for the control of *Musca domestica*, L., and other flies. One of the measures that may be required is the use over a large area of a sweetened arsenical bait-spray, which has given excellent results at Montecatini [*R.A.E.*, B **20** 207]. Instances are given of the successful use of this spray in other Italian towns.

PEUS (F.). **Zwei bisher unbekannte Arten der Stechfliegengattung *Haphospatha* Enderlein aus Mitteleuropa (Dipt., Stomoxydidae).** [Two hitherto unknown Species of *Lyperosia* from Central Europe.] —*Z. angew. Ent.* **24** no. 1 pp. 150–154, 6 figs., 7 refs. Berlin, April 1937.

Characters distinguishing the male of *Lyperosia* (*Haphospatha*) *scopolax*, sp. n., and both sexes of *L.* (*H.*) *bovina*, sp. n., from allied species are shown in a key. *L. scopolax* was taken in Hungary and *L. bovina* on cows in Latvia.

BRUMPT (E.). **Cycle évolutif de *Piroplasma canis* chez les Ixodinés.**—*C. R. Soc. Biol.* **124** no. 10 pp. 928–931. Paris, 1937.

Work on the development of *Piroplasma canis* in ticks is briefly reviewed [*cf. R.A.E.*, B **21** 76; **24** 189]. In a study of sections of numerous nymphs and adults of the three known natural vectors, the author obtained negative results with *Rhipicephalus sanguineus*, Latr., and *Haemaphysalis leachi*, Aud., but in *Dermacentor reticulatus*, F., it was possible to follow the development of a strain of *P. canis* from the environs of Paris. In 4 out of 5 ticks taken from an infected dog, intense multiplication of the parasites was observed in the cells of the digestive tract, whereas in ticks from other dogs the process of multiplication took place in the sub-cuticular cells, the muscular cells, and sometimes even in the conjunctive or migratory cells in different parts of the body. Later, parasites were found to be more or less prevalent in the walls of the ovaries and in the ovules, where they were associated with various symbionts, and particularly in the salivary glands, where a type of sporoblast showing numerous nuclei produced isolated elements in which the nucleus divided and which finally gave rise to small germs with a single nucleus that are undoubtedly the infective forms.

The various developmental forms were also found in adults of both sexes fed on refractory hosts, such as hedgehogs and guineapigs, but the most intense infections were usually observed in those ticks that had infected a dog and then reabsorbed parasites from it.

The author points out that in parasites of the genus *Plasmodium*, which are also endoglobular, the metacyclic forms (sporozoites) actually terminate the cycle of development in the Arthropod host, whereas in those of the genus *Piroplasma*, the infective forms in the progeny of infected ticks seem to develop from vermicular forms arising from the sporoblasts. These vermicular forms seem to be able to produce new sporoblasts, and this type of multiplication can be repeated a number of times in ticks infected hereditarily and reared on refractory hosts. Thus, in the case of *Rhipicephalus sanguineus*, piroplasmosis was transmitted to a dog by the bites of about 100 ticks of a strain reared for 5 generations on hedgehogs. This experiment, which demonstrates the repetition of the parasite cycle in the tick without the ingestion of parasites (gametes) from the blood of a dog, suggests that *Piroplasma canis* is a parasite of ticks, transmitted hereditarily in them, which only accidentally gives rise to developmental forms attracted to the salivary glands and capable of infecting dogs.

Schwetz (J.). **Notes éthologiques sur les phlébotomes du Bas-Congo.**—*C. R. Soc. Biol.* **124** no. 10 pp. 1015–1017, 2 refs. Paris, 1937.

A visit to various parts of the Bas-Congo Province of the Belgian Congo in 1936 showed that sandflies (*Phlebotomus*) were widely distributed, and examples that had engorged naturally or experimentally on human blood always proved to be *P. schwetzi*, Adl., Thdr. & Parr. Sandflies were, however, found only in localities where there were ditch latrines, though where they occurred in large numbers in the vicinity of latrines, they were sometimes found in other places, such as native huts or even European houses. The association of sandflies with latrines is inexplicable, since the larval stage is passed in detritus and not in polluted water. They bite at all times of the night as well as in the middle of the day in the shade.

Blanc (G.) & Baltazard (M.). **Transmission expérimentale du typhus murin par la puce de l'homme** (*Pulex irritans*).—*C. R. Soc. Biol.* **124** no. 11 pp. 1058–1059, 14 refs. Paris, 1937.

The literature on the transmission of murine typhus by various species of fleas is briefly reviewed, and it is pointed out that only once has transmission by *Pulex irritans*, L., been mentioned [*R.A.E.*, B **20** 143], and in that case no details of the work were given. Experiments were therefore carried out in which examples of this flea were allowed to feed on infected rats and then on healthy ones, which were changed every two days. Infectivity was determined by inoculating guineapigs with crushed fleas or with the brains of the rats on which they had fed. It was found that *P. irritans* is infected in the same way and as easily as *Xenopsylla cheopis*, Roths. [*cf.* **24** 157]; the date of the appearance of the virus in the flea was the same, and the fleas remained infected throughout life. The frequency with which *P. irritans* occurs on rats, the readiness with which it leaves them, and the fact that of all the fleas that live on rats it is the only one that frequently attacks man indicate that it is of primary importance in the accidental infection of man with murine typhus.

Brain (C. K.). **Report on the Southern Rhodesia Trypanosomiasis Committee and Bureau.**—Fol., 22 pp. multigraph, 1 map. [Salisbury, S. Rhodesia.] 1937.

The occurrence of sleeping sickness in Europeans in circumstances that indicated a local centre of infection [*cf. R.A.E.*, B **23** 201] drew attention to the importance of the disease in Southern Rhodesia and resulted in the formation of the Trypanosomiasis Committee and Bureau in 1934. The Committee, which consisted of representatives of the various sciences concerned in a study of trypanosomiasis, was appointed to consider questions relating to the disease in man and animals in Southern Rhodesia, to submit reports, and to make representations to the Government. The function of the Bureau was to collect, collate and distribute information concerning the disease in Southern Rhodesia and elsewhere. This report gives the history of the Committee and Bureau and the work they have performed, and includes the findings of the Committee on the policy of game destruction as a means of controlling *Glossina morsitans*, Westw. [*cf.* **24** 201], and a progress report by L. E. W. Bevan giving the latest results of his research work on immunity, treatment, etc. [*cf.* **25** 61].

Hall (D. G.). **The North and Central American Spider Parasites of the Genus *Pseudogaurax* (Diptera : Chloropidae).**—*J. Wash. Acad. Sci.* **27** no. 6 pp. 255–261, 7 figs., 2 refs. Menasha, Wis., 15th June 1937.

The species dealt with include *Pseudogaurax* (*Gaurax*) *signatus*, Lw., which has often been bred from egg-sacs of *Latrodectus mactans*, F., in numerous localities in the southern part of the United States and is evidently distributed throughout North America wherever this spider occurs.

Hermans (E. H.) & van Thiel (P. H.). **Exotische aandoeningen in Nederland : Myiasis.** [Exotic Affections in the Netherlands : Myiasis.]—*Ned. Tijdschr. Geneesk.* **80** (1) no. 7 pp. 648–654. Amsterdam, 15th February 1936. Repr. in *Acta leidensia* **10–11** pp. 120–132. Leyden, 1936. (With Summaries in English, French and German.)

A description is given of a case of cutaneous myiasis caused by *Cordylobia anthropophaga*, Grünb., that was observed in Rotterdam in a sailor arriving from the west coast of Africa. He stated that he had never left the ship during his last three voyages to Africa, and had never been in contact with natives, and that his linen was washed on board. Since the largest larva was in the 3rd instar, it is possible that he was already infested when the ship left Africa.

In this connection, the various forms of myiasis and the possible means of infestation of the skin by fly larvae are reviewed.

MacLeod (J.). **The Nature, Epidemiology and Control of Sheep Myiasis in Britain. A Summary of our Present Knowledge.**—*J. comp. Path.* **50** pt. 1 pp. 10–32, 52 refs. Croydon, March 1937.

During recent years, much new information has been obtained on the nature and causes of myiasis of sheep in Britain and on the habits of the flies concerned, and in this paper an attempt is made to collect the scattered material and relevant data from other parts of the world, and to give an account of the present position of the problem.

In Britain, open sores left by the action of blowfly larvae are often aggravated by the adults of other species of flies, particularly those of the genus *Fannia*, which suck the blood and serous exudations, spread septic infection, and irritate the skin so that the biting or rubbing of the infected part by the sheep results in the rapid extension of the area of the wound. These flies are of special importance in lowland flocks in Scotland ; no means of control that will also allow the healing of the wound is known and the open wound renders the sheep continuously susceptible to further attack by blowflies. A common cause of strike is the presence of extraneous organic matter in the fleece ; blood from abrasions and cuts or from the bursting of engorged ticks has been reported as one source of such matter, and another, which is one of the commonest, is the putrefying of dead larvae resulting from the dressing of a previous strike with a rapidly toxic larvicide. In this connection it is pointed out that the preparations of glycerine and boric acid that have proved effective against blowfly strike in Australia [*cf. R.A.E.*, B **23** 292 ; **24** 133] are unsuitable for use under the climatic conditions of Britain, since the

larvae killed by the dressing are prevented from drying up (probably by the glycerine) and putrefy in the fleece, and the presence of this hygroscopic and sometimes semi-liquid material results in further attacks by the fly, and, when the toxic principle becomes exhausted, in re-infestation by larvae. In areas where foot-rot is common, the suppurating lesion is frequently attacked by blowflies, but it has been found that if the larvae are left in the wound they clean it more effectively than an antiseptic dressing does.

MORISON (G. D.). **Some Results of Trapping the Sheep Blowfly** (*Lucilia sericata* **Meigen**).—*Scot. J. Agric.* **20** no. 2 pp. 123–134, 25 refs. London, April 1937.

As a part of the investigation on the sheep blowfly, *Lucilia sericata*, Mg., begun at Aberdeen in 1933 [*cf. R.A.E.*, B **24** 41], a study has been made of various problems connected with trapping flies, and the results are given in the present paper. The rearing of flies from maggots collected in different parts of the country between the dates of the earliest and latest records showed that this species is the only serious cause of strike in Great Britain. Other species were reared so seldom that they can be of little importance and may have invaded the lesions due to *L. sericata* or some other external cause. Small, simple traps of the same pattern were used in the experiments; they were baited with liver partly immersed in a 25 per cent. solution of sodium sulphide in water to prevent the bait from drying up and increase its attraction [*cf.* **20** 188]. The sites selected for the traps are briefly described. The total catch of flies from each trap varied considerably, and it is concluded that *L. sericata* has a distinct preference for a combination of moist carrion, warmth, sunlight, and shelter from wind, since the largest numbers were taken in traps exposed to the sun all day, but sheltered from strong wind, and close to places where sheep or cattle congregate during periods of sunshine [*cf.* **22** 184]. The first examples of *L. sericata* were caught on 7th and 10th June in 1933 and 1934, respectively. Males were trapped during the same period as females but were about 10 times less numerous; they are probably less attracted to bait, since they do not require a meal of protein before pairing. The fact that *L. sericata* forms only a small proportion of the total catch was confirmed [*cf.* **22** 184]; it averaged about 3 per cent. in the 7 traps used throughout the season in 1933. A number of beetles and about 40 other species of flies, including a number of predacious ones, were taken, but all are harmless to sheep, except 2 species of *Calliphora* which cause very little injury.

L. caesar, L., and *L. illustris*, F., formed about half the total catch, and since *L. sericata* resembles them in colouring, structure and size, the efficacy of trapping may well be overrated by those who are unable to distinguish them. No flies were caught on continuously wet or cold dull days, few when spells of sunshine occurred between longer periods of showers or when strong winds were blowing, a fair number on damp warm days, many when one or two showers fell during a bright, warm day, and most when the weather was hot or warm with sunshine and no strong wind. The variations in the numbers of sheep struck during the period of trapping on the farms corresponded quite well with the variations in numbers of flies caught. It is, incidentally, considered that the comparatively small proportion of

blowflies caught makes the value of trapping to reduce strike appear doubtful. Moreover, numbers of flies that normally compete with the blowfly are also destroyed [*cf.* **18** 273], and the cost of purchasing and operating the traps would be considerable.

Work on trapping carried out in Australia, South Africa and the United States is briefly reviewed. An ideal trap should be cheap, durable and large enough to catch many thousands of flies without the dead ones blocking the entrance. It should have some means of keeping the bait moist and of preventing the flies from breeding in it, and the part containing the catch of flies should be separate from that containing the bait so that each may be cleaned without disturbing the other. Various suggestions are made for the construction and maintenance of traps. Farmers have used carrion, usually a dead rabbit, hung over a stream, but this seems unlikely to produce any significant reduction in the blowfly population, especially as blowfly larvae falling into the water could survive immersion for long periods. Moreover, when the carcasses of 4 rabbits were used to test the value of this bait, numerous adults of *Calliphora erythrocephala*, Mg., and of *L. caesar* and *L. illustris* were obtained, but not a single example of *L. sericata*.

McCulloch (R. N.). **A Single-sheep raised Jetting Race, with some Notes on Calcium Arsenite.**—*Agric. Gaz. N.S.W.* **48** pt. 3 pp. 149–152, 173, 7 figs. Sydney, 1st March 1937.

A description is given of a jetting race (through which the animals walk in single file) that has proved very satisfactory in the treatment of sheep against blowflies at Trangie Experiment Farm. The method of preparing calcium arsenite jetting mixture is again described [*R.A.E.*, B **22** 124; **24** 39].

van Hoof (L.), Henrard (C.) & Peel (E.). **La piqûre de la glossine infectieuse.**—*Ann. Soc. belge Méd. trop.* **17** no. 1 pp. 59–62, 2 refs. Brussels, 31st March 1937.

In an attempt to study the trypanosomes injected by the bites of tsetse flies, experiments were carried out in which batches of *Glossina palpalis*, R.-D., that included at least one fly infected with *Trypanosoma gambiense* were fed on defibrinated or citrated blood contained in a funnel by allowing them to pierce a membrane stretched over its mouth. In preliminary experiments, no trypanosomes were found in the blood in the funnel, although subsequent dissections showed that some of the flies were infected and that they had fed through the membrane. In later experiments, each fly of a batch was fed separately on a healthy guineapig so that the infected ones could be isolated. In one of these experiments, in which a single infected fly was used, 12 short trypanosomes without free flagella were observed in the blood in the funnel after it had been centrifuged; in the fresh preparation they were very active. In a second experiment, the same fly was fed after 4 days' starvation but no trypanosomes were seen; in a third experiment, it fed after 3 days' starvation and 2 trypanosomes were found. In both the successful experiments, the trypanosomes did not differ in size from those seen in the blood of experimental animals. The fly was subsequently used for other experiments, and when it was eventually dissected, trypanosomes

were abundant in the salivary glands. Another fly, isolated in the same way, was subjected to two experiments, with negative results. On dissection, a few dead trypanosomes were found in the intestines, but none in the proventriculus or the glands, although it had infected a guineapig. It would thus appear that infected flies leave only a few parasites in the blood on which they feed, even though these may be numerous in the salivary glands and other parts of the body.

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). **Sur la transmissibilité cyclique de trypanosomes "*brucei*" et "*congolense*" conservés depuis longtemps dans les laboratoires.**—*Ann. Soc. belge Méd. trop.* **17** no. 1 pp. 63–76, 4 refs. Brussels, 31st March 1937.

An account is given of experiments carried out at Leopoldville to test the transmissibility by tsetse flies (*Glossina*) of strains of *Trypanosoma congolense* and *T. brucei* isolated in 1927 and 1932, respectively, and since maintained in laboratories by mechanical passage to laboratory animals. *T. congolense* had apparently lost the ability to complete its development in *Glossina palpalis*, R.-D.; it was found that the guineapig was not a good experimental animal owing to its resistance to infection even when bitten by flies naturally infected when caught. On the other hand, *T. brucei* had retained its ability to develop in the fly. The indices of transmissibility [*cf. R.A.E.*, B **22** 126] in three successive transmissions were not high (2, 1·7 and 0·9), but were comparable with the index of 1·9 obtained with a strain of *T. rhodesiense* that had undergone only 3 mechanical passages.

VINCKE (I.) & DEVIGNAT (R.). **Le foyer de peste du Lac Albert.**—*Ann. Soc. belge Méd. trop.* **17** no. 1 pp. 87–110, 2 maps, 1 chart, 6 refs. Brussels, 31st March 1937.

Preliminary investigations on plague in the part of the Kibali-Ituri District of the Belgian Congo bordering on Lake Albert were undertaken in 1928 and 1929; it was found to be of murine origin, with *Mastomys coucha* var. *ugandae* as the chief reservoir. Various measures, including the destruction of rats, were undertaken, and the number of deaths during the period 1931–33 was small. In 1934 a fresh outbreak occurred, and an account is here given of the results of subsequent investigations. The plains near the Lake and the River Semliki are only sparsely inhabited, but the high plateau (4,550–6,500 ft.), where the greatest number of cases of human plague occurs, is well-populated.

A total of 44,612 examples of *M. coucha* var. *ugandae* were examined by groups caught in separate localities, and 12 strains of murine plague were isolated. Severe epizootics appear to coincide with cases of human plague. Murine plague, which is irregularly distributed in isolated foci, rapidly dies out. A number of other rodents, including *Arvicanthis abyssinicus*, were examined, but no plague infection was discovered in them. However, since plague in *M. coucha* var. *ugandae* occurred at the rate of only 1 case per 3,718 individuals, the figures for the semi-domestic rodents are too small for definite conclusions.

Of 13,032 fleas taken on *Mastomys*, 91·2 per cent. were species of *Xenopsylla* (6,149 examples of *X. cheopis*, Roths., and 5,740 of *X. brasiliensis*, Baker).

No relation between temperature, altitude and the species of fleas was observed. A large number of fleas was taken in collections of dust, particularly in those from unswept corners of straw huts, which

are damper and contain a higher proportion of cereal débris. Only species of *Xenopsylla* and *Ctenocephalides* (*Ctenocephalus*) seem able to live in débris on the surface of the ground; *Dinopsylla* and *Chiastopsylla*, when not on their hosts, remain in the burrows; species of *Leptopsylla* have never been found apart from their hosts. Strains of murine plague were found in the zones of both *X. cheopis* and *X. brasiliensis*, but there was always at least 20–30 per cent. of *X. cheopis* present, whereas in certain cases there was less than 10 per cent. of *X. brasiliensis*; certain localities where plague occurred appeared to be foci where *X. cheopis* predominated within the zone of *X. brasiliensis*. *X. cheopis* was the better vector of plague between rats. On the other hand, most cases of human plague appeared to occur in areas where *X. brasiliensis* predominated.

It is suggested that there is a threshold in the flea index below which transmission is not possible and that this threshold may not be the same for both species of fleas, nor for man and rat; *X. cheopis* may prefer rats and *X. brasiliensis* man. An epidemic and an epizootic would be favoured by an optimum mixture of the two species and a rise in the index due to undetermined climatic conditions. The whole region is feebly enzootic, foci being widespread and irregular; when conditions become favourable for the spread of plague among rats, these centres become epizootic, unsuspected foci giving rise to isolated human cases, and foci where there is a noticeable mortality among rats, to epidemics. This explains simultaneous outbreaks of plague at great distances from one another.

A description is given of measures for the control of the rats, including the burning of infested huts and the use of protective trenches.

Wanson (—) & Nicolay (—). **Biologie de *Culex fatigans* dans le Bas-Congo.**—*Ann. Soc. belge Méd. trop.* **17** no. 1 pp. 111–122, 19 refs. Brussels, 31st March 1937.

An account is given of field and laboratory observations on the bionomics of *Culex fatigans*, Wied., in the Bas-Congo. In Matadi, where it has become rare, it usually breeds in subterranean water. On the rare occasions when it invades European houses it invariably breeds in the septic tanks.

In Boma, which is surrounded by marshes, the systems for draining sewage and rainwater are defective, and the river water sometimes flows back up the drains and floods a large part of the surrounding land. Anophelines were usually found out of doors and *Aëdes* (*Stegomyia*) in houses, whereas *Culex* was found everywhere, in domestic receptacles, tree-holes, drains, wells, etc., and in all polluted water, septic tanks being clearly the permanent and residual foci. In Boma, as well as in Banana, *C. fatigans* is widely distributed and attacks man voraciously after sunset [*cf. R.A.E.*, B **23** 256]. The larvae are found in water with a hydrogen-ion concentration ranging from 5–10, the optimum being about 8. They are adaptable to a high degree of salinity, and at Banana developed normally in concentrations of up to 30 grams of chloride per litre. The adults seem to be rather more attracted to natives than to Europeans; in a native hospital, 77 per cent. were found engorged with human blood, whereas in a European house, 28 out of 56 contained human blood, 27 avian and the last a mixture of human and avian. The females are active only at night.

The life-cycle, as observed in the course of 80 rearings between 15th February and the end of July, was similar to that at Dakar [*cf. loc. cit.*]. The first blood meal was taken 48–72 hours following emergence, and the first egg raft was laid 96–120 hours later. When kept without food, the adults died in 4 days without ovipositing. The maxillary index estimated from 200 individuals varied between 9·5 and 10. In the dry season, when the night temperatures out-of-doors varied between 18 and 23°C. [64·4 and 73·4°F.], all strains of *C. fatigans* continued to bite and engorge, but their repeated feeds on man, fowl or guineapig were no longer accompanied by the maturation of eggs and oviposition, and after a maximum period of 30 days all females died.

In order to determine whether it was possible under laboratory conditions to produce races showing definite host preferences, two lots of larvae were reared in water polluted with the excrement of guineapigs and birds, respectively. In both cases, the life-cycle from egg to adult lasted 8 days at an average temperature of 28°C. [82·4°F]. For 4 generations, adults reared from these larvae were fed on guinea-pigs and fowls, respectively. Adults of the fifth generation of the first strain engorged readily on a fowl or man and those of the second strain fed equally well on guineapig or man. These same strains were reared to the 7th generation on guinea-pigs and fowls, and to the 10th on man. Of the 6th generation, a large number of females preferred to die of starvation rather than feed on fowls or guineapigs and the number of eggs laid by the few females that fed was much reduced. The 7th generation of adults all refused to feed, and the strains died out, thus confirming Galliard's finding [**24** 216]. Adults that fed on man gave rise to normal and numerous progeny for the five following generations, when the experiment was terminated.

SCHAFFER (P. S.), HALLER (H. L.) & FINK (D. E.). **Toxicity of Phenothiazine Derivatives to Culicine Mosquito Larvae.**—*J. econ. Ent.* **30** no. 2 pp. 361–363, 1 fig., 4 refs. Menasha, Wis., April 1937.

Derivatives of phenothiazine (thiodiphenylamine) were prepared to determine whether the toxicity of a molecule known to possess insecticidal action can be increased by the introduction of various atoms and radicals. Of 11 such derivatives tested against fourth-instar larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.), 6-methyl-phenothiazine at 2 parts per million gave 48·5 per cent. mortality in 16 hours, whereas phenothiazine at 1 part gave 100 per cent. The other derivatives were even less toxic.

AYROZA GALVÃO (A.) & LANE (J.). **Notas sobre os** *Nyssorhynchus* **de S. Paulo. II. Descrição de uma nova especie,** *Anopheles* (*Nyssorhynchus*) *pessôai* (**Diptera, Culicidae**).—*Rev. Biol. Hyg.* **7** (2) pp. 67–79, 7 figs., 13 refs. S. Paulo, December 1936. [Recd. June 1937.]

Anopheles pessôai, sp. n., is described from the larva and adult, larvae having been collected in S. Paulo in well-lit shallow pools with abundant algae and grasses, and bred out in the laboratory. The characters differentiating it from the closely related *A. pictipennis*,

Phil. (*albitarsis*, Arrib.) are given, with keys to the adults of the *argyritarsis* series and to the larvae and male hypopygia of the *Nyssorhynchus* group in S. Paulo.

PAPERS NOTICED BY TITLE ONLY.

SERGENT (Et.). **Les oeufs d'*Anopheles hispaniola* Theo.**—*Arch. Inst. Pasteur Algérie* **15** no. 1 pp. 102–103, 1 pl., 3 refs. Algiers, 1937.

PARROT (L.). **Notes sur les phlébotomes. XXIV.—Sur le mâle de *Phlebotomus vesuvianus* Adler et Theodor, 1931.**—*Arch. Inst. Pasteur Algérie* **15** no. 1 pp. 104–107, 4 figs., 3 refs. Algiers, 1937. **XXV. Sur l'appareil génital interne des phlébotomes.**—*T.c.* pp. 108–123, 11 figs., 7 refs.

DIEMER (J. H.). **La méthode de Heincke de combinaison des caractères pour la détermination raciale d'un exemplaire isolé d'*Anopheles maculipennis*.**—*Acta leidensia* **10–11** pp. 62–67, 2 figs., 10 refs. Leyden, 1936. [*Cf. R.A.E.*, B **23** 269; **24** 95.]

DIEMER (J. H.) & VAN THIEL (P. H.). **Investigations on the racial purity of *Anopheles maculipennis atroparvus* and *messeae* in the Netherlands.**—*Acta leidensia* **10–11** pp. 68–94, 7 figs., 11 graphs, 15 refs. Leyden, 1936. [*Cf. R.A.E.*, B **23** 269.]

DIEMER (J. H.) & VAN THIEL (P. H.). **Remarks with regard to the "Courte instruction pour la détermination des variétés d'*Anopheles maculipennis*" by the Malaria Committee of the League of Nations.**—*Acta leidensia* **10–11** pp. 95–105, 3 figs., 17 refs. Leyden, 1936. [See *R.A.E.*, B **24** 286.]

REUTER (J.). **A preparatory Investigation on the Cause of the Behaviour of *Anopheles maculipennis* in the Choice of Food.**—*Acta leidensia* **10–11** pp. 260-267. Leyden, 1936. [Reprint of summary: *R.A.E.*, B **24** 223.]

VAN THIEL (P. H.). **Onderzoekingen omtrent het gedrag van *Anopheles* ten opzichte van mensch en dier, mede in verband met de rassenstudie bij *Anopheles maculipennis*.** [Investigations concerning the Behaviour of *Anopheles* towards Man and Animals, in connection with the Study of Races in *A. maculipennis*.]—*Acta leidensia* **10–11** pp. 268–298, 1 pl., 2 figs., 17 refs. Leyden, 1936. [See *R.A.E.*, B **24** 89.]

HACKETT (L. W.). **Recent Additions to our Knowledge of "*Anopheles maculipennis*" Races** [review of literature published since 1934].—*Quart. Bull. Hlth Org. L.o.N.* **6** no. 1 pp. 1–16, 31 refs. Geneva, February 1937.

SHUTE (P. G.). **The Morphology of the external Spines of the Harpagos of a single Race of *Anopheles maculipennis* var. *atroparvus*, and its Value for diagnostic Purposes.**—*Riv. Malariol.* **16** (1) pt. 3 pp. 199–201, 2 pls., 3 refs. Rome, 1937.

COVELL (G.). **The Distribution of Anopheline Mosquitoes in India. Revised and brought up to date by I. M. Puri.**—*Hlth Bull.* no. 17 (*Malar. Bur.* no. 8) [6] 43 pp., 1 map. Delhi, Manager of Publications, 1936. Price 8*d*. [*Cf. R.A.E.*, B **20** 121.]

CHRISTOPHERS (S. R.), SINTON (J. A.) & COVELL (G.). **How to do a Malaria Survey. Third Edition revised by J. A. Sinton.**—*Hlth Bull.* no. 14 (*Malar. Bur.* no. 5) viii + 206 pp., 11 pls., 3 figs., many refs. Delhi, Manager of Publications, 1936. Price 2*s*. 6*d*. [*Cf. R.A.E.*, B **19** 167.]

COVELL (G.). **Anti-mosquito Measures with Special Reference to India.**—*Hlth Bull.* no. 11 (*Malar. Bur.* no. 3) 4th edn. (revd.) iii + 60 pp., 4 refs. Delhi, Manager of Publications, 1935. Price 5*d*. [*Cf. R.A.E.*, B **15** 144.]

WALKER (E. M.). **The Larval Stages of *Wohlfahrtia vigil* (Walker).**—*J. Parasit.* **23** no. 2 pp. 163–174, 24 figs., 9 refs. Lancaster, Pa, April 1937.

[OLSUF'EV (N. G.).] **Олсуфьев (Н. Г.). Faune de l'URSS. Insectes Diptères Vol. VII, no. 2. Fam. Tabanidae.** [*In Russian.*]—*Inst. zool. Acad. Sci. URSS*, N.S. no. 9, xiii + 434 pp., 216 figs., 4 pp. refs. Moscow, 1937. Price 15 *rub.*; binding 2 *rub.* [Including 1 new genus, 28 new species and 5 new subspecies, together with translations in German of the keys and descriptions of the new genus, species and subspecies (pp. 359–428).]

[PERFIL'EV (P. P.).] **Перфильев (П. П.). Faune l'URSS. Insectes Diptères Vol. III, no. 2. Psychodidae (Phlebotominae).** [*In Russian.*]—*Inst. zool. Acad. Sci. URSS*, N.S. no. 10, viii+145 pp., 111 figs., 7 pp. refs. Moscow, 1937. Price 5 *rub.*; binding 2 *rub.* [Including a new variety and translations in French of the keys to both sexes of the genus *Phlebotomus*.]

[RODENDORF (B. B.).] **Родендорф (Б. Б.). Faune de l'URSS. Insectes Diptères Vol. XIX, no. 1. Fam. Sarcophagidae (Pt. 1).** [*In Russian.*]—*Inst. zool. Acad. Sci. URSS*, N.S. no. 12, xv+501 pp., 535 figs., 3 pp. refs. Moscow, 1937. Price 18 *rub.*; binding 2 *rub.* [Including 13 new genera, 15 new subgenera, 54 new species, 8 new subspecies and 5 *nom. nud.*, together with translations in German of the keys and descriptions of the new genera, subgenera, species and subspecies (pp. 393–496).]

HALL (D. G.). **New Muscoid Flies (Diptera) in the United States National Museum** [including *Myocera tabanivora* reared from a Tabanid larva].—*Proc. U.S. Nat. Mus.* **84** no. 3011 pp. 201–216, 8 figs. Washington, D.C., 1937.

HARBINSON (C. F.). **The Adobe Tick** [*Ornithodorus turicata*, **Dugès**] **on** *Gopherus agassizii* [in California].—*Herpetologica* **1** no. 3 p. 80. Chicago, 15th July 1937.

SCHULZE (P.). **Die Ixodoidea der Galapagos-Inseln.** [The Ixodoidea of the Galapagos Islands.]—*Medd. zool. Mus. Oslo* no. 45 pp. 155–162, 5 figs., 20 refs. Oslo, 1936. [Recd. 31st May 1937.]

THOMPSON (G. B.). **The Parasites of British Birds and Mammals. XIII. Records of Siphonaptera bred from Birds' Nests.**—*Ent. mon. Mag.* **73** no. 876 pp. 105–107. London, May 1937.

GUIMARÃES (L. R.). **Notas sobre Siphonapteros com a descripção de uma nova especie.** [Notes on Siphonaptera with a Description of a new Species (*Rhopalopsyllus truncatus*) from a wild cat, ***Felis*** *catus*, in S. Paulo, Brazil).]—*Arch. Hyg. Saude publ.* **2** pp. 141–143, 2 pls. S. Paulo, 1936. [Recd. June 1937.]

Johnson (C. G.). **The relative Values of Man, Mouse, and Domestic Fowl as Experimental Hosts for the Bed-Bug,** *Cimex lectularius* **L.**—*Proc. zool. Soc. Lond.* (A) **107** pt. 1 pp. 107–126, 16 refs. London, April 1937.

Cimex lectularius, L., feeds on the blood of many animals as well as on that of man, and the experiments described were undertaken to determine by the aid of statistical methods whether certain aspects of the biology of the bugs vary when they are reared under similar conditions but on different hosts, in this case, man, mouse and domestic fowl. The last two were chosen as they may possibly serve as hosts in urban districts.

The following is from the author's summary: All immature stages and adults of both sexes of *C. lectularius* feed on man, mouse and domestic fowl. The bug can be bred to the adult stage on any of these hosts, and such adults pair and produce fertile eggs. The rate of development from egg to adult is slightly greater on mouse than on man or fowl. Given equal opportunity for feeding once in every instar, a greater proportion of bugs reach maturity on mouse than on man and the lowest proportion on fowl. Whilst it is shown that the shorter period for development on mouse is correlated with a relatively heavy blood-meal, bugs fed on fowl, which also develop more quickly than on man, do not always take heavier meals. Bugs bred on mouse are heavier and produce more eggs at the first feed than bugs bred on man or fowl. Some unknown factor also appears to contribute to this increased egg-production. Mated adults and second-instar nymphs live longer when starved after a single blood-meal on man than on either mouse or fowl. This is not obvious in the unmated adults until the variation in length of life associated with weight of meal is eliminated; then it is seen that unmated bugs, too, live longest when fed on man. This may be due to the greater proportion of dry material in the blood of man than in that of either mouse or fowl. Bugs fed on man appear to be slightly better fitted for survival after one meal than those fed on fowl. The primary reasons for the differences in the life of bed-bugs living on man, mouse and fowl in nature are more likely to lie in differences in the behaviour of the insects in the presence of those hosts than in the physical effects of the meals.

Munro (J. A.). **Fly Trapping and its Application to Human Welfare.**—*Circ. N. Dak. agric. Exp. Sta.* no. 60 pp. 3–8, 2 refs. Fargo, N. Dak., September 1936. [Recd. 1937.]

Bruce (W. G.). **Seasonal Appearance and relative Abundance of Flies caught in a baited Trap at Fargo.**—*T.c.* pp. 9–12, 3 figs.

In the first part of this circular, a popular account is given of the bionomics and control of flies. In the second, the seasonal prevalence and relative abundance of the species found at Fargo, North Dakota, are briefly discussed from data obtained in trapping experiments carried out in 1929–31. The traps, which were made of metal screening, were each baited with liver and an over-ripe banana, with the addition of enough water to fill the bait pan; a few drops of nicotine sulphate were placed in the water to act as a larvicide. *Musca domestica*, L., and *Phormia regina*, Mg., constituted about three-quarters of the total number of flies trapped, the former being most abundant from July until October and the latter from mid-May until mid-July.

ALICATA (J. E.). **The Gizzard-worm, and its Transmission to Chickens in Hawaii.**—*Circ. Hawaii agric. Exp. Sta.* no. 11, 7 pp., 10 figs., 2 refs. Honolulu, January 1937.

Recent studies have shown that the intermediate hosts of the gizzard worm of fowls, *Cheilospirura hamulosa*, in nature in Hawaii include *Tenebroides nanus*, Melsh, 6 per cent. of which were found infected on a farm on Maui, and certain species of grass-hoppers. Various invertebrates were fed on eggs of the worm and 10 species of beetles associated with poultry manure, chicken food, etc., and 3 species of grasshoppers were found to serve as intermediate hosts.

DAVIES (W. M.) & HOBSON (R. P.). **Sheep Blowfly Investigations.**—*J. Minist. Agric.* **44** no. 3 pp. 222–230, 12 refs. London, June 1937.

Investigations on the problem of the infestation of sheep by *Lucilia sericata*, Mg., are being carried out in north Wales and a brief, somewhat popular account is here given of the results that have so far been obtained [*cf. R.A.E.*, B **22** 132; **23** 227; **25** 52]. A summary of the development of the fly on sheep is included. It is suggested that crutching, which involves the shearing of the wool from above the tail and around the hind legs and is a method of control commonly used in Australia [*cf.* **24** 38; **25** 51], could be carried out with advantage. There is evidence that a certain condition of the wool, referred to in Australia as " wool rot," predisposes sheep to attack. Normally the wool grease and products of excretion of the skin are distributed uniformly through the wool, and if the wool is parted, there is no indication of colouring or accumulation of waxy products, but if this condition is present, these products form a crusty layer at the base of the wool. As the wool grows, the crusty layer passes upwards and ultimately appears on the outside of the fleece. As a rule, the wool also becomes matted and consequently moisture penetrates easily. Blowflies select such sites for oviposition and will thrust eggs actually into the crust.

Tests of various proprietary dips used primarily for the control of sheep scab demonstrated that they exercised no marked repellent effect on the flies. Further tests to determine their value in destroying the newly-hatched maggots showed that those containing arsenical compounds were the most effective, but there were indications that, even when used at half strength, they damaged the skin, and a search is therefore being made for a dip of equal larvicidal value that will be non-injurious.

ROMAN (E.). **Sur quelques Arthropodes vulnérants récoltés en Camargue.**—*Bull. Soc. ent. Fr.* **42** no. 9 pp. 131–136, 5 figs. Paris, 1937.

Brief notes are given on a number of blood-sucking Arthropods collected in Camargue in June 1936, including *Leptoconops irritans*, Noé, and *Culex* (*Barraudius*) *modestus*, Fic., which are believed to be recorded for the first time from France.

Knipling (E. F.) & Bruce (W. G.). **Three unusual Host Records for Cuterebrine Larvae (Diptera: Oestridae).**—*Ent. News* **48** no. 6 pp. 156–158, 2 refs. Philadelphia, Pa, June 1937.

A second-instar larva of *Cuterebra buccata*, F., was found among larvae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) taken from the shoulder of a mule in South Carolina in July 1935, and it is suggested that it was the predisposing cause of the attack by *C. hominivorax*. Another second-instar larva of the same species was extracted from the back of a cow in Florida in September. A second-instar larva of another species of *Cuterebra* was removed from the wind-pipe of a pig in Georgia in November; the animal appeared healthy in every respect, but suddenly began to cough violently and died within an hour. Apparently there has been no previous record of *Cuterebra* attacking cattle or mules.

Kohls (G. M.). **Hosts of the immature Stages of the Pacific Coast Tick** *Dermacentor occidentalis* **Neum. (Ixodidae).**—*Publ. Hlth Rep.* **52** no. 16 pp. 490–496, 5 refs. Washington, D.C., 16th April 1937.

Since *Dermacentor occidentalis*, Marx, may prove to be of importance as a vector of diseases of man and animals [*cf. R.A.E.*, B **17** 172; **21** 239; **24** 208], studies were carried out in Oregon and California between 5th May and 13th October 1935 and 17th April and 15th August 1936 on its life-history and hosts. The natural hosts of the immature stages are recorded in this paper. Nymphs and larvae were found on a variety of animals, including large numbers of small rodents, of which ground squirrels (*Citellus*) and deer mice (*Peromyscus*) are probably the most important, on account of their abundance and general distribution in tick-infested regions.

Stewart (W. L.). **The Control of Sheep Ticks.**—*J. R. agric. Soc. Engl.* **97** pp. 81–95, 2 pls., 4 graphs. London, 1936.

After briefly describing the life-history of *Ixodes ricinus*, L., in Britain [*cf. R.A.E.*, B **20** 274; **24** 249; etc.] and louping-ill and tick-borne fever, the two diseases of sheep that it transmits [*cf.* **21** 58; **24** 249, etc.], the author gives an account of experiments carried out in Northumberland to determine whether dipping with a mixture known as "anti-tick" and containing arsenic, carbolic acid and wool grease, which had given promising results in preliminary tests, would be effective in reducing the tick population on sheep in the field. It had been found that the dipped sheep were relatively free from ticks for about 14 days and that the deterrent effect of the mixture was greater than that of each component alone. In 1934, heavy losses were reported among lambs on tick-infested farms in Northumberland. They were due in part to louping-ill and tick-borne fever, and in part to a crippling condition characterised by abscess formation, also thought to be due to ticks, since suppurating sores are frequently found at the site of tick-bites. It was stated that an enormous increase in the tick population on sheep and lambs had taken place during the previous years. Systematic dipping experiments were therefore carried out at intervals of three weeks on four tick-infested farms in 1935 and 1936 and the results checked by weekly counts of the ticks

present on sheep selected at random from dipped and undipped sheep. An interval of three weeks was chosen as it was hoped that the sheep would remain relatively uninfested for two weeks and would act as traps for ticks (which would subsequently be destroyed by the dip) during the third week. The "anti-tick" dip was used at a strength of 0·17 per cent. arsenious oxide.

It is concluded from the results that the dip kills engorging ticks less rapidly than an ordinary good arsenical dip, but has a more lasting effect. Its repeated use causes no injury to the fleece or the skin. If ewes are carefully handled, they can be dipped with safety at any time during the period March-May, which is roughly the main tick season. The times of autumn dippings should be chosen to coincide with the second tick season [*cf.* **20** 274]. Dipping of ewes and their young lambs is quite possible when suitable measures are taken to prevent the lambs being separated from their mothers, but lambs less than two weeks old should not be treated. Dipped lambs throve better than undipped ones ; it has not yet been possible to estimate precisely the effect of dipping on the mortality of lambs from tick-borne diseases, but efforts to do this will be made in the future. In all cases the tick population of the flocks was much reduced by the treatment.

KEAY (G.). **The Ecology of the Harvest Mite** (*Trombicula autumnalis*) **in the British Isles.**—*J. Anim. Ecol.* **6** no. 1 pp. 23–35, 26 refs., 1 map. Cambridge, May 1937.

From replies to enquiries it has been found that *Trombicula autumnalis*, Shaw, is widely distributed in the British Isles. More records were received from localities on calcareous soil than from those on any other type. Its occurrence is often sporadic, but the limiting factors are unknown. The larvae were found in summer on various wild and domestic mammals and birds ; they tend to infest particular parts of the body on each. In winter they were observed in the ears of rabbits and bank voles (*Clethrionomys glareolus*). Nymphs were obtained from larvae ; success depends on leaving the larvae on the host until they are fully fed and on keeping the soil moist. A brief account is given of the species of *Trombicula* parasitic on man in different parts of the world and of the diseases they transmit.

OHMORI (N.). **The tropical Rat Mite and its Control.** [*In Japanese.*]—*Kagaku no Taiwan* **5** no. 2 pp. 255–261, 4 figs. Taihoku, Formosa, April 1937.

In Formosa, the tropical rat mite [*Liponyssus nagayoi*, Yamada] is common in Taihoku and also in the south-east at Taito. A brief account is given of its bionomics [*cf.* *R.A.E.*, B **19** 156 ; **24** 60 ; **25** 19] ; it attacks man most often in autumn, winter and spring. Destruction of rats in houses and soaking infested clothes in hot water or soap solution are recommended for control. The mites can also be killed by sprays of 2 lb. paradichlorobenzene in 1 gal. petrol or 1 lb. naphthalene in a mixture of 6 pints petrol and 2 pints petroleum oil. The second spray is the more effective, but causes some damage to clothes and upholstery, which the first does not. Spraying should be repeated at intervals for about two weeks.

Picado, T. (C.). **Estudo experimental sobre o veneno de** *Lethocerus del-pontei* **(De Carlo) (Hemiptera. Belastomidae).** [An experimental Study of the Venom of *L. delpontei*.]—*Mem. Inst. Butantan* **10** (1935–36) pp. 303–310, 1 pl. S. Paulo, 1937. (With a Summary in English.)

The salivary secretion of *Lethocerus delpontei*, De Carlo, a predatory Belostomatid of tropical America, was found to be extremely poisonous. It hastens the coagulation of normal, non-citrated blood of both man and rabbit, and haemolyses, more definitely than any snake poison, the red cells of rabbit, but not those of man. It does not seem to be neutralised by any serum excepting the *Crotalus terrificus* antivenin.

Raynal (J.). **Contribution à l'étude des phlébotomes d'Indochine. III.—Distribution géographique des phlébotomes d'Indochine Nord. Quelques aspects de leur biologie.**—*Arch. Inst. Pasteur Indochine* no. 23 pp. 349–374, 5 pls., 5 maps, 5 pp. refs. Saigon, April 1936. [Recd. 1937.]

The geographical distribution and adult habits of sandflies (*Phlebotomus*) in northern Indo-China are discussed, first in general and then for each of 10 species [*cf. R.A.E.*, B **24** 105]. Sandflies are rare or very localised in the delta and coastal regions of Tonkin and Annam ; they are most prevalent in the wooded hilly country between these regions and the mountains at altitudes ranging from about 100 to 500 ft. *Phlebotomus stantoni*, Newst., was the only species found in the high valleys in Tonkin, and *P. barraudi*, Sinton, at localities in Yunnan and Laos at an altitude of 3,900–5,200 ft. [*loc. cit.*]. The former was the most abundant species in the north of Indo-China, but was gradually replaced towards the south by *P. bailyi* var. *campester*, Sinton, which is the predominating species in Annam. Sandflies were rarely caught in dwellings and seldom in the forest or bush ; they were sometimes found in the vicinity of small domestic animals, in fowl houses, rabbit hutches or kennels, but most usually in uninhabited or little-used buildings, such as cart sheds, latrines, etc. In Tonkin the adults were scarcer during the coldest months of the winter (January-March) and seemed to disappear completely at this time in the high valleys. They also disappeared during periods of high wind and heavy rain ; they were taken in largest numbers when fine weather followed rain. These findings may explain their preference for well-built, sheltered resting places. The results of a study of the stomach contents of certain species have already been noticed [*loc. cit.*].

Stewart (J. L.). **Report on the Eradication of Tsetse-fly of the** *G. palpalis* **Group from the Pong-Tamale Area, Northern Territories, Gold Coast.**—*Gold Coast, no. 1 of 1937*, 18 pp., 1 col. map, 18 refs. Accra, Govt. Ptg Dep. ; London, Cr. Ag. Colon., 1937.

A detailed account is given of the work done and results obtained in the eradication of *Glossina palpalis*, R.-D., and *G. tachinoides*, Westw., from the area surrounding the Veterinary Station built at Pong Tamale in 1930–31. Much of the information has already been noticed from the reports of the Veterinary Laboratory [*cf. R.A.E.*, B **25** 41 ; **24** 55 ; **22** 237 ; etc.]. The recommendations of K. R. S. Morris, on which the clearing work was originally based, are quoted,

and the history of the clearing carried out from 1930 onwards is reviewed. In 1936, the entire main (Naboggo) river and lagoons throughout the area and for some distance beyond it, and all secondary streams and water-holes within the area had been cleared of all low shade, and barrier clearings had been made on the flanks to prevent the ingress of tsetse flies during the rains. The principle has been the elimination of the combination of water and low shade, which is essential for flies of the group of *G. palpalis* either for lengthy sojourn or for breeding. At present, any flies that may be driven into the area by flooding elsewhere or by following man or animals are likely to be few in number, and, finding no refuge, to die or move out of the area. This happened in the wet season of 1936, and the scheme appears to have been successful, though it will be necessary to maintain constant watch to prevent foci from becoming re-established. At the beginning of the work, the Naboggo River was regarded as the primary focus from which all the tsetse flies in the Pong Tamale area originated, and this in turn was thought to be re-populated from the River Volta. This hypothesis has been proved by this large scale experiment to be fallacious, and it is now considered that the numerous ponds, streams and water-holes nearer to the station should have been cleared first. Although most of them dry up during the long dry season, *G. tachinoides* is invariably found at such uncleared foci as soon as water appears. It is possible that fly manages to exist at such foci when they are dry, and although no direct proof is yet available, it is remarkable that the flies found in them were all unmarked, in spite of the liberation of thousands of marked flies at the nearest points of the uncleared parts of the river. Further work to prove or disprove this point is being undertaken.

In such slow-running rivers as the Naboggo, which is typical of the savannah country of most of West Africa, it would seem that there is little fear that clearing will produce serious erosion. On stretches where no trees have been left on the banks, such a profuse growth of grass has occurred that there has been no more erosion than before clearing, and, in spots where grass is scanty, a thick carpet of *Portulaca* has appeared. In the dry season, several hundred cattle from Pong Tamale farm and from villages graze and water at the Naboggo, but even where the banks are subject to constant trampling, no erosion has been observed.

In 1936, 10,000 flies were caught, marked and liberated at the eastern and 5,000 at the western end of the cleared part of the main river. The lateness of the rains enabled catching at the main river to be continued for much longer than usual, so that larger numbers of flies were caught. The practical deduction from the marking experiments [*cf.* **24** 56; **25** 41] is that when flies of the *G. palpalis* group, particularly *G. tachinoides*, leave their usual habitat during the floods in the rainy season, they can travel considerable distances by taking advantage of the ordinary cover found in woodland and savannah, and can even cross open plains provided that there are a few bushes. If within an area (such as that in which the experiment was undertaken) there are scattered spots where conditions are suitable, the flies reach them and establish themselves. A few flies were found in June 1936 in the vicinity of some small streams that had been imperfectly recleared and showed considerable secondary growth ; all were old and had probably been there for some time. Wide clearings were made along the courses of these streams and large numbers of trees that are not usually removed were destroyed, so that open glades 200–300 yards wide and

suitable for grazing were substituted for savannah in order to ensure that these valleys, so close to the main farm, should not provide cover or breeding grounds for stray flies. No flies were caught there during the wet season of 1936, even at the time of their dispersal from primary foci during the floods, although a few were caught in savannah woodland throughout the area at the commencement of flooding. At the time of the floods, which in 1936 occurred in September instead of mid-August, a dozen fly-boys searched the entire area and only 13 stray examples of *G. tachinoides* were caught. The clearing of the secondary streams prevented the flies from establishing themselves. Under dry season conditions, flies do not leave their normal habitat and spread throughout the terrain, but they will frequently leave the low cover for short periods in search of food. In experiments, *G. tachinoides* has been caught up to 800 yards from cover on sunny days with a shade temperature of 100°F. and a low relative humidity. With the exception of these darts from cover, the flies do not wander until the advent of the lower temperatures of June and July, when they frequently occur outside their normal cover (although seldom further than half a mile) and often linger for an appreciable time under high shade trees.

The lists given of the trees and bushes composing the vegetation along the rivers of the Northern Territories are rather more exhaustive than the ones in the report for 1935–36 [**25** 41]. At Pong Tamale practically no large trees were cut down in the course of clearing [**22** 237], and during five years' continuous observations, no case of pupation occurring under a high shade tree (one that has a clean bole for 10 feet above ground level) has occurred. The predominant tree of this type in the rivers and swamps of the Northern Territories is *Daniellia oliveri*; flies of the *G. palpalis* group are frequently found beneath such trees during the early rains from June to mid-August, but they do not remain for more than a few hours and pupae do not occur there. Moreover, in the absence of high shade trees near tsetse cover, the flies are found in the open. The author considers that such trees should not be destroyed, particularly as the root system is spreading and consequently valuable in preventing erosion. It is suggested that all cleared African rivers might be planted with avenues of high shade trees.

Continued observations on the Naboggo River have shown that at no time are flies completely absent, although it was previously believed that they were driven away at the time of flooding during August–September and did not return until mid-February [**21** 12]. Even when the floods are at their height and only the tops of the fringing bush in the uncleared parts of the river are not submerged, the fly population was considerable. Early in October 1936, out of 36 flies caught in two hours by workers in a canoe, 10 had been marked and liberated at the same spot in June–July. Dissection of considerable numbers of these flies, all of which were *G. tachinoides*, revealed that their principal food is mammalian blood. As no mammals can approach the habitat at this time, the flies must cross flooded areas, often several hundred yards wide, in search of food; they were found to be readily attracted to fly-boys stationed up to 500 yards distant. Numerous gravid females were caught among the foliage of the unsubmerged tops, and pupae and pupal cases were easily found in cracks and holes in tree trunks, particularly when these contained mould. The tree preferred for larviposition appeared to be *Vitex*

chrysocarpa, although *Mitragyna inermis* growing near the banks was also used. The suggestion that clearing might be simplified by cutting fringing bush on each side of flooded areas and leaving it uncut where the banks are flooded cannot now be entertained. It should be noted that low shade and humidity are still present in these tree-top habitats.

It seems possible that *G. tachinoides* can withstand slightly higher temperatures and lower humidities than *G. palpalis*; this would account for the presence of the latter on the uncleared tributary of the Naboggo [**25** 42] and on other streams in the Northern Territories where conditions at the end of the dry season are somewhat less arid than in spots where *G. tachinoides* is found. The tributary is more heavily shaded in a deep bed with deep pools, whereas the Naboggo itself is wider, shallower and not so heavily shaded throughout. There is an abundance of game on the tributary, especially the larger animals, which are rare or absent on the plains of the Naboggo valley. *G. tachinoides* appears to have no specific host, but prefers mammalian blood to that of birds or reptiles. The most common mammals are kob, baboons, red monkeys, man, reedbuck and duiker, in that order. The population of this species has been found to fluctuate regularly according to environment and season; the catches per fly-boy hour since 1930 have averaged 6 from November to February, 40–50 from March to July and 15 from August to October, taking October as the last month of the rains. The first period is the dry season when the harmattan blows constantly. The figures for the third period, when the river is flooded, is based on catches made only in 1936, when it was discovered that the flies remained among the upper branches of the partly submerged trees. In the first period most of the flies are old and hard-bodied; in the second the proportion of young, soft-bodied flies increases until June and then decreases until, in the third period, few young flies are to be found. Pupation on a large scale begins in December, but there is no marked emergence until the harmattan has ended; the largest numbers of pupae have been found in March and April.

Since 1933, 1,813 flies have been dissected, of which 104, all *G. tachinoides*, were found to be infected, 59 with *Trypanosoma vivax*, 2 with mixed *T. vivax* and *T. congolense*, 7 with *T. congolense*, 1 with *T. brucei*, 3 with a trypanosome resembling *T. vittatae* and 32 with unidentified trypanosomes, most of which were probably degenerate forms of *T. vivax*.

CORSON (J. F.). **A Note on the Infectivity to Man of a Strain of** *Trypanosoma rhodesiense* **maintained in Sheep.**—*J. trop. Med. Hyg.* **40** no. 12 pp. 141–142, 1 ref. London, 15th June 1937.

The strain of *Trypanosoma rhodesiense* isolated on 1st October 1934 and found to be infective to man in March 1936 [*cf. R.A.E.*, B **24** 217] continued to be maintained in sheep by cyclical passages through *Glossina morsitans*, Westw., and was found to be infective to man in August 1936, and again in March 1937 after it had been transmitted through two reedbucks in succession by single flies. There is no reason to think that the strain had become less infective or less virulent to man during the period of 29 months in animals and flies.

Jackson (C. H. N.). **Water and Fat Content of Tsetse Flies.**—*Nature* **139** no. 3520 pp. 674–675, 3 refs. London, 17th April 1937.

Mellanby (K.). **Water and Fat Content of Tsetse Flies.**—*T.c.* no. 3525 p. 883, 4 refs. London, 22nd May 1937.

Jackson endorses Jack's view [*R.A.E.*, B **25** 124] of the importance of subtracting the weight of "fat" from both the gross wet and gross dry weights of tsetse flies before calculating the percentage of water contained in them, and discusses the question, using figures obtained in his recent study on *Glossina morsitans*, Westw., in Tanganyika Territory [**25** 162].

Mellanby doubts the value of this procedure, since there are many other constituents of an insect's body that vary greatly in weight. The quantity of haemolymph or circulating fluid should be taken into consideration in any study of the water balance of insects, since the variations in its volume will affect the gross analyses enormously, whether the "fat" content is subtracted or not. Laboratory studies [**25** 92] have shown that the gross percentage of water in tsetse flies may vary more widely than Jack's and Jackson's field observations indicate without their being harmed or their metabolic rates being affected, and they must lose a great deal of water, probably equivalent to the whole of their haemolymph, before they suffer from desiccation.

Swan (D. C.). **Insects and other Invertebrates of Economic Importance in South Australia during the period July 1934, to June 1936.**—*J. Dep. Agric. S. Aust.* **40** no. 9 pp. 717–731, 13 figs., 15 refs. Adelaide, April 1937.

The medical and veterinary section of this paper (pp. 727–729) includes notes on *Echidnophaga gallinacea*, Westw., a pest of fowls that was first reported from South Australia in 1922 and has now spread to the settled parts of the State *via* the transcontinental railway in spite of quarantine restrictions [*cf.* *R.A.E.*, B **14** 90]; *Pulex irritans*, L., which was found breeding in litter on the earthen floors of outbuildings sheltering pigs, cows and poultry and was numerous in them and in neighbouring dwellings; *Ceratophyllus fasciatus*, Bosc, which was taken on a rat in Adelaide in June 1934; and *Oestrus ovis*, L., a common pest of sheep in the State, which is reported to congregate each summer in large numbers on the walls of a farmhouse at Murraytown. Reference is made to dermatitis caused by *Pediculoides ventricosus*, Newp., which appears to be distributed generally throughout the cereal belt [*cf.* **22** 167], and by *Trombicula hirsti*, Sambon [*cf.* **18** 223]. The immature stages of *Simulium ornatipes*, Skuse, were found in several streams in 1934; this species is not known to attack man. No previous records of the occurrence of Simuliids in South Australia have been found except one by Lea [**6** 178], which the author considers is more likely to refer to Chironomids.

Jellison (W. L.). **A new Species of *Thrassis* (Siphonaptera).**—*Publ. Hlth Rep.* **52** no. 23 pp. 726–729, 6 figs., 1 ref. Washington, D.C., 4th June 1937.

Adults of both sexes of *Ceratophyllus* (*Thrassis*) *pandorae*, sp. n., are described from *Citellus elegans* in Montana. It was also taken in

this State from *C. armatus*, in Oregon from *C. oregonus* and in Wyoming from an unidentified species of *Citellus*. It is closely allied to *Ceratophyllus* (*T.*) *petiolatus*, Baker, which was originally described from *Lynx canadensis*, but is usually found on *Citellus columbianus*. In areas where there was a mixed population of *C. elegans* and *C. columbianus*, these two species of fleas occurred on their respective hosts. The new species was collected in south-western Montana in the course of studies on sylvatic plague, it was the most abundant of the four species of fleas commonly found on ground squirrels in epizootic areas in Wyoming, and was also taken in epizootic areas in Oregon, so that it may possibly be a vector.

Eskey (C. R.). **Plague Infection found in Fleas and Lice taken from Ground Squirrels in Washington State.**—*Publ. Hlth Rep.* **52** no. 23 pp. 748–749. Washington, D.C., 4th June 1937.

Fleas and lice taken in April 1937 from *Citellus townsendi* in Adams County, Washington State, were proved by animal inoculation and cultural reactions to be infected with plague. It is believed that this is the first positive evidence that plague exists among wild rodents in Washington and that the locality in which the fleas and lice were collected is the most northern point at which it has been found in the United States.

Roy (D. N.). **The Physiology of the Digestion in Larvae of** *Gastrophilus equi*.—*Parasitology* **29** no. 2 pp. 150–162, 15 refs. Cambridge, 30th April 1937.

As a result of this study on digestion in the larvae of *Gastrophilus intestinalis*, DeG. (*equi*, Cl.), the author concludes that they do not feed on blood but on the partly digested fluid material in the stomach of the horse; it is probably for this reason that horses do not show any symptoms even when they are heavily infested.

Steward (J. S.). **The Occurrence of** *Onchocerca gutturosa* **Neumann in Cattle in England, with an Account of its Life History and Development in** *Simulium ornatum* **Mg.**—*Parasitology* **29** no. 2 pp. 212–219, 1 pl., 8 refs. Cambridge, 30th April 1937.

Descriptions are given of the adults and microfilariae of *Onchocerca gutturosa* found in cattle in Cambridgeshire and Herefordshire [*cf. R.A.E.*, B **24** 197]. The parasites appeared to be intermediate in form between *O. gutturosa* and *O. bovis*, and though they more closely resembled the former, *O. bovis* is regarded as a probable synonym of it. A number of species of blood-sucking flies were dissected in the search for the vector of the parasite, but all were negative except species of *Simulium*. In 1933, dissection of 48 examples of *S. ornatum*, Mg., that had fed on an infected cow, revealed microfilariae in 21, and a series of specimens in all stages of development was obtained. Negative results were obtained in 1934 from dissection of 173 examples of *S. salopiense*, Edw., and 122 of *S. reptans*, L., that were fed on the same cow, but from an examination of the cow's skin it would appear that the microfilariae were much less numerous than in 1933. However, among 20 engorged examples of *S. erythrocephalum*, DeG., a living microfilaria was found in one that had fed on the cow three days

previously. The microfilariae are taken from the skin with the blood of the cow into the mid-gut of the fly. Within a few days, they migrate forwards into the thoracic muscles, where they reach the "sausage" stage after about 10 days. Between the 19th and 22nd day, they migrate forwards to the head and appear to be ready for emergence from the proboscis. It is believed that the infective forms may lie in the anterior portion of the thorax just posterior to the head and migrate into the proboscis at the time of feeding.

SHARIF (M.). **On the Life History and the Biology of the Rat-flea,** *Nosopsyllus fasciatus* **(Bosc).**—*Parasitology* **29** no. 2 pp. 225–238, 24 refs. Cambridge, 30th April 1937.

As fleas live on blood throughout their life-cycle, they are suitable for experiments to determine whether haematophagous insects suck blood because they lack in their bodies the iron essential for their growth. Previous work on the biology of fleas is briefly summarised. The experiments described were carried out with *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, Bosc, and details of the technique are given. Care was taken to use only unfed larvae and to prevent the food, or the sand with which it was mixed, from being contaminated with other organic substances. Rearing was carried out at a constant temperature of 23°C. [73·4°F.] and a relative humidity of 80 per cent.; no appreciable difference in results was apparent with relative humidities of 80 and 90 per cent., but mites were observed frequently in desiccators at the latter humidity and rarely in those at the former. The incubation period was 3½–4½ days. The duration of the larval period varied considerably, and depended not only on temperature and humidity but also on food. The third-instar larvae form cocoons 2–3 days after defaecating, and the adults emerge after 10–12 days, of which 7–8½ days are spent in the pupal stage.

The following is taken from the author's summary: It is experimentally shown that although blood is the most important part of the nutritional requirements of the larvae, they also require for normal development an additional food, which in nature is supplied by the organic refuse present in the bed of the host of the adult flea. Fibrin has no nutritive value; serum and red corpuscles are equal in value. Retarded development indicates some deficiency in the food. Serum possesses all the proteins essential for normal development, but its lack of the requisite amount of iron leads to an increase in the percentage of mortality and to delay in development. A similar result is obtained with red corpuscles or haemoglobin, which are rich in proteins containing iron, but lack some others necessary for normal growth. It was also proved that the larvae feed on blood to obtain the supply of iron necessary for their normal growth. The denatured proteins of the blood and its constituents have no nutritive value.

ROUBAUD (E.). **Variations de l'oeuf chez l'***Anopheles maculipennis* **(biotype** *atroparvus***).**—*Bull. Soc. Path. exot.* **30** no. 4 pp. 279–283, 1 fig., 3 refs. Paris, 1937.

The author describes a melanic variation of the eggs of *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel, that he has observed over a number of years in the coastal region of La Vendée, in which the cuneiform spots more or less disappear and the eggs may be entirely

dark, as are those of the type described as *melanoon*, Hackett [*R.A.E.*, B **22** 200]. Such a variation has been observed in batches laid by wild or by reared females and may affect the whole of a batch or only a part. It is not hereditary, since a batch of about 150 dark eggs gave rise to adults that laid normal dappled eggs, and it appeared fortuitously in a series of normal eggs. In a mixed batch, all gradations between normal dappled eggs and entirely dark eggs were observed. It may be the effect of earlier hybridisation or possibly the ageing of the ovipositing female.

These variations in the eggs of *atroparvus* would appear up to a point to be comparable to those recently observed in the race *labranchiae*, Flni., on the coast of Algeria [*cf.* **24** 311]; but with regard to the suggestion that race *sicaulti*, Roub. [**23** 146] is not distinct, the author points out that the characters of the eggs of this race have been shown to be constant, hereditary and stable in the progeny, and, moreover, that the more obtuse form of the egg would be sufficient to differentiate it from that of *labranchiae* even without the colour characters. There are undoubtedly variations in the eggs of *labranchiae*, but they have not been studied in the progeny. It is, however, possible that the two related north African races, *labranchiae* and *sicaulti*, may interbreed at the points where their areas of distribution overlap and that the effect of such crossings may appear in the eggs and so account for the extreme variations observed by Sergent [**24** 311].

It would appear that no racial value should be given to characters in the eggs unless these are shown to be stable in successive generations.

Guibert (M.). **Les glossines du Cameroun.**—*Bull. Soc. Path. exot.* **30** no. 4 pp. 283–286, 1 map. Paris, 1937.

During 1936, collections of *Glossina* and other blood-sucking flies were received from different parts of the French Cameroons. The species of *Glossina*, in the order of abundance, were *G. palpalis*, R.-D., *G. tachinoides*, Westw., *G. pallicera*, Big., *G. tabaniformis*, Westw., *G. fusca*, Wlk., *G. caliginea*, Aust., *G. morsitans*, Westw., and *G. longipalpis*, Wied. Their distribution is shown on a map. To the north of Yabassi, *G. palpalis*, *G. pallicera*, *G. tabaniformis*, *G. fusca* and *G. caliginea* were reported as biting at 6 o'clock in the morning and as late as 7 or even 7.30 at night from March to November; no data are available for the rest of the year. Among the other flies were *Chrysops dimidiata*, Wulp, *C. silacea*, Aust., and *Haematopota vittata*, Lw.

Le Gac (P.). **Note sur la présence à Diego-Suarez (Madagascar) de** *Triatoma rubrofasciata* **(de Geer 1773).**—*Bull. Soc. Path. exot.* **30** no. 4 pp. 286–287. Paris, 1937.

Triatoma rubrofasciata, DeG., is recorded from Diego-Suarez, Madagascar, where it was found only during the rainy season from November to May. It is attracted to electric lights at dusk. Microscopic examination of the contents of the rectum revealed a flagellate of the *Crithidia* type in 70 per cent. of the bugs.

Bevan (C. E.). **Notes on the Distribution and Breeding-places of Mosquitos in Northern Abyssinia.**—*Bull. ent. Res.* **28** pt. 2 pp. 279–287, 1 pl., 1 map, 8 refs. London, July 1937.

Notes are given on the mosquitos collected by the author in northern Abyssinia between December 1935 and March 1936 while he was

serving with the British Red Cross Ambulance Service. Records are limited almost entirely to places where the Ambulance remained long enough to enable adults to be bred from larvae. The 61 specimens obtained were identified as *Anopheles cinereus*, Theo., *A. christyi*, N. & C., *A. garnhami*, Edw., *Culex annulioris*, Theo., *C. theileri*, Theo., *C. andersoni*, Edw., and *Aëdes quasiunivittatus*, Theo., of which the first four have not previously been known to occur in Abyssinia. The breeding places are discussed. A list of the mosquitos that have now been reported from Abyssinia is appended.

GIBBINS (E. G.). **Simuliidae of the Buganda, Eastern and Western Provinces of Uganda.**—*Bull. ent. Res.* **23** pt. 2 pp. 289–309, 11 figs., 23 refs. London, July 1937.

The pupae, cocoons and adults of both sexes of *Simulium obscurum*, sp. n., *S. touffeum*, sp. n., and *S. octospicae*, sp. n., and the larvae of the first, are described, the female of *S. neavei*, Roub., is re-described, and further details [*cf. R.A.E.*, B **21** 206] of the female terminalia of *S. damnosum*, Theo., from the type locality at Jinja are added. A note is included on the pupal respiratory organ of *S. elongensis*, Gibbins, from Kabale, and a statement is given of the distribution of Simuliids in the Buganda, Eastern and Western Provinces of Uganda, together with brief notes on their breeding places and blood-sucking habits where they are known. Examination of one of the five females on which De Meillon based his description [**18** 239] showed *S. nyasalandicum* to be a synonym of *S. neavei*.

BURKE (A. W.). **An Epidemic of Jungle Yellow Fever on the Planalto of Matto Grosso, Brazil.**—*Amer. J. trop. Med.* **17** no. 3 pp. 313–334, 2 maps, 17 refs. Baltimore, Md, May 1937.

A detailed account is given of an epidemic of 201 cases of yellow fever of the jungle type [*cf. R.A.E.*, B **24** 34] that occurred in the absence of *Aëdes aegypti*, L., on the Planalto of Matto Grosso, Brazil, in 1934 and 1935 [*cf.* **23** 257]. The results of protection test surveys suggest that the outbreak did not originate from immediately preceding urban outbreaks transmitted by *A. aegypti*, and high immunity rates among Indians indicate that it was the result of the endemicity of the disease in the Amazon jungle. The sera from five monkeys (*Cebus*) caught in districts known to be infected, all gave positive results in protection tests, indicating that they had acquired immunity in the jungle. The immunity survey of the area revealed more than half the cases discovered ; rural immunity rates were higher than village rates, and rural rates rose as the proximity of the house to fields and jungle increased. All available evidence points to infection being contracted in clearings adjoining uncleared jungle or in the jungle itself, especially during working hours.

In an entomological survey in the dry season (May–August) of 1934, 49 species of mosquitos were taken [*cf.* **24** 111], and of these *Psorophora ferox*, Humb., *Haemagogus* sp., and *Aëdes scapularis*, Rond., were considered as possible vectors. In a further survey during the rainy season (September–April) of 1935, the mosquito fauna was similar ; *P. ferox* and mosquitos of the genus *Haemagogus* were again abundant, but *A. scapularis* was taken in smaller numbers than during

the dry season. Other blood-sucking Arthropods collected were Simuliids, Tabanids, *Culicoides*, Triatomids, mites, and various species of ticks, including *Amblyomma cayennense*, F.

BONNE (C.). **The natural Host of** *Trypanosoma* (*Crithidia*) *conorhini* **Donovan.**—*Amer. J. trop. Med.* **17** no. 3 pp. 393–399, 1 fig., 10 refs. Baltimore, Md, May 1937.

A brief account is given of investigations carried out in Java, which showed that the house rat, *Mus* (*Rattus*) *rattus diardii*, is a natural host of *Trypanosoma conorhini* [*cf. R.A.E.*, B **25** 164]. Infection in rats could only be detected by finding the trypanosome in laboratory bred larvae of *Triatoma rubrofasciata*, DeG., that had been allowed to feed on them [*cf.* **24** 89]; 3 out of 20 rats collected from houses infested by *T. rubrofasciata* were found to be infected.

BARBER (M. A.) & RICE (J. B.). **A Survey of Malaria in Egypt.**—*Amer. J. trop. Med.* **17** no. 3 pp. 413–436. Baltimore, Md, May 1937.

An account is given of an investigation on the prevalence of malaria in the Nile Valley, which was carried out during August–December 1936. The weather was exceptionally warm. The rainfall is insignificant, but water supplied by irrigation systems from the Nile provides breeding places for mosquitos.

Malaria was more or less prevalent in all of the 29 localities surveyed in the Delta, but in many the parasite index was relatively low. Localities in the vicinity of rice-fields or of larger lakes nearly all had comparatively high indices. *Anopheles pharoensis*, Theo., *A. multicolor*, Camb., and *A. coustani*, Lav. (*mauritianus*, Grp.) were more or less common. Larvae of the first were found in almost all stagnant or semi-stagnant waters containing vegetation, and were especially abundant in rice-fields and in or at the borders of lakes. *A. coustani* was common in ponds and ditches, especially where the water was partly shaded by reeds; it predominated in certain rice-fields after the plants had reached maturity and partly shaded the water. *A. multicolor* sometimes occurred in very large numbers, particularly in brackish water. During October and early November, when the level of the ground water is high, larvae and pupae of this species were frequently numerous in the water of village cesspools, but the parasite index in such villages was often very low. Adults of *A. pharoensis* were remarkably scarce in dwellings and stables, even when breeding places in the vicinity contained numerous larvae and pupae. In tents, the number was often much greater. The adult density of *A. multicolor* was also very low in comparison with the abundance of its larvae and pupae, often in the immediate vicinity of dwellings; the maximum catch was only three in any one survey. *A. coustani* was rarely found in any village building, even when larvae were plentiful in a neighbouring rice-field. There was some indication that the density in houses was greater in desert and semi-desert regions.

The sporozoite and oöcyst indices in examples of *A. pharoensis* were 0·33 and 6·7 for all localities and 0·53 and 10·8 for a hospital encampment, the only place in which sporozoite infection was observed. Laboratory bred adults of *A. pharoensis* allowed to feed on carriers of *P. falciparum* and *P. vivax* became infected, but the percentages were

low and the number of oöcysts small. Thus there is further evidence that the results of laboratory infection experiments, unless carried out with large numbers and with special precautions, cannot be taken as indicative of the degree of infection in nature. Among specimens giving positive reactions in precipitin tests, 97 per cent. of those collected in houses and tents and 10 per cent. of those collected in stables had fed on man. On the whole, it is very probable that *A. pharoensis* is a vector of importance in Egypt [*cf. R.A.E.*, B **24** 295], in spite of the fact that its density in dwellings and its sporozoite index are low. The warm season in Egypt is very long, so that the comparatively small number of infective mosquitos is less significant than in regions where the summer is shorter. *A. multicolor* was infected in the laboratory with *P. falciparum*; it was not found infected in nature, but only 13 specimens were dissected.

Notes are also given on surveys in the Siwa Oasis (Western Desert) and the Suez Canal Zone, which were carried out on 8th–9th and 17th–18th November, respectively, but the data obtained were insufficient to justify any conclusion regarding the vectors of malaria.

The extirpation of malaria from Egypt would hardly be possible without a radical change in the system of irrigation. As a palliative measure, the distribution of *Gambusia* is recommended. The suggested restriction of rice cultivation to areas distant from large centres of population is likely to prove beneficial.

Boyd (M. F.) & Kitchen (S. F.). **A Consideration of the Duration of the intrinsic Incubation Period in Vivax Malaria in Relation to certain Factors affecting the Parasites.**—*Amer. J. trop. Med.* **17** no. 3 pp. 437–444, 1 ref. Baltimore, Md, May 1937.

Using data obtained in 157–172 successful inoculations of man with *Plasmodium vivax* by means of infected examples of *Anopheles quadrimaculatus*, Say, the authors attempt to correlate the duration of the intrinsic incubation period (number of days elapsing from the injection of sporozoites by the mosquitos until the parasites are first detected in thick smears of the patient's blood) with various factors that might conceivably affect sporogony.

The following is taken from their discussion: The length of the intrinsic incubation period in those subsequently inoculated does not appear to be influenced by the length of the intrinsic incubation period in the source of infection, the period of the primary attack in the source of infection at which the mosquitos are infected, or the duration of the extrinsic incubation period, but it varies inversely with the dosage of sporozoites injected, as measured roughly by the number of mosquitos employed. The suggestion of an increase in duration following the use of mosquitos with old gland infections may be attributable to a smaller dosage of viable sporozoites injected. Apart from the dosage of sporozoites, the varying susceptibility of the different human hosts would appear to exert a greater influence than any discernible factor that might modify the sporozoites.

Bonne-Wepster (J.) & Brug (S. L.). **Nederlandsch-Indische Culicinen.**—*Geneesk. Tijdschr. Ned.-Ind.* **77** no. 9–10 pp. 515-617, 45 figs., 16 refs. Batavia, 2nd March 1937.

This work, which is to be issued in the form of a booklet, has been prepared in view of the increase in knowledge of the mosquitos of the

Netherlands Indies since the publication of a previous one [*R.A.E.*, B **13** 8]. It is intended for use by medical men, and the greater part of it consists of descriptions of the adults of both sexes of a large number of the principal species, with notes on their breeding places and distribution and, in some cases, other bionomics and relation to disease. It also includes keys to the genera and species and notes on the technique of mosquito collection and examination of mosquito vectors of filariasis.

Brug (S. L.). **De overbrenging van *Filaria malayi* te Kalawara (o. a. Paloe, Res. Menado).** [The Transmission of *F. malayi* at Kalawara, Paloe Subdivision, Menado Residency.]—*Geneesk. Tijdschr. Ned.-Ind.* **77** no. 24 pp. 1462–1470, 1 diagr., 6 refs. Batavia, 15th June 1937. (With a Summary in English.)

Filariasis due to *Filaria malayi* is epidemic at Kalawara, Celebes, where elephantiasis also occurs. Early in 1937, 144 mosquitos were taken on heavily infected cases and dissected from ½ to 10½ days later. *F. malayi* was found in 95 out of 96 examples of *Anopheles barbirostris*, Wulp, and in 1 out of 2 of *Mansonia uniformis*, Theo. The other 46 mosquitos, none of which was infected, comprised species of *Aëdes* and *Culex* and one example of *M. annulifera*, Theo. Development of *F. malayi* in *Anopheles barbirostris* was completed in 8½ days, and mature larvae were sometimes found in the head after 6½ days. No immature larva was seen in mosquitos dissected after 9½ days.

Of 304 mosquitos taken in dwellings or on man, 271 were *A. barbirostris*, of which 22 were infected. No infection was found in the remaining 33 mosquitos, of which 22 were *M. uniformis*. In cow-sheds 194 mosquitos were taken, including 96 examples of *A. barbirostris*, 41 of *A. bancrofti*, Giles, and 28 of *M. uniformis*. Infection occurred in 2 of *A. barbirostris* and 1 of *A. bancrofti*. Though *A. barbirostris* seldom attacks man in other parts of the Malay Archipelago, it does so readily in Celebes, at both Kalawara and Mamoedjoe [*R.A.E.*, B **20** 218]. On the other hand, *A. bancrofti* is generally considered to feed freely on man, but did not seem to do so at Kalawara.

Galliard (H.). **L'évolution de *Dirofilaria immitis* Leidy chez *Aëdes* (*Stegomyia*) *aegypti* et *A. albopictus* au Tonkin.**—*C. R. Soc. Biol.* **125** no. 15 pp. 130–132, 7 refs. Paris, 1937.

Numerous workers in different parts of the world have obtained positive results in the infection of *Aëdes aegypti*, L., with *Filaria* (*Dirofilaria*) *immitis* [*R.A.E.*, B **20** 9; **23** 282; **25** 71], but in experiments in Paris [**25** 124], the results with both this species and *A. albopictus*, Skuse, were negative. In the course of recent investigations by the author in Hanoi, development of the microfilariae took place in about 60 per cent. of the examples of *A. aegypti*; in no case was it arrested, although sometimes it seemed to be retarded, for young, active larvae were present in the malpighian tubes at a time when infective forms were observed in the head and proboscis. On the other hand, in only 1 out of 15 examples of *A. albopictus* were larvae seen in the head and proboscis; in 4, young living larvae were found in the malpighian tubes; and in 1, such larvae were associated with mature larvae in the thorax (on the 20th day at a temperature of 27°C. [80·6°F.]). Possible reasons for the discrepancies in the results obtained by different workers using *A. aegypti* are discussed. The

author considers that they are less likely to be due to differences in races of the mosquito than to differences in strains of the parasite [*cf.* **25** 124].

Galliard (H.). **Un parasite de l'homme, nouveau pour l'Indochine *Filaria malayi* Brug 1927.**—*Bull. Soc. méd. chir. Indochine* **14** no. 8 pp. 1091–1093, 8 refs. Hanoi, October 1936. **Ponte et évolution larvaire de *Mansonia indiana* et *Mansonia annulipes* dans le delta du Tonkin.**—*C. R. Soc. Biol.* **125** no. 19 pp. 491–492, 2 refs. Paris, 1937.

The finding of microfilariae of *Filaria malayi* in the blood smears of hospital patients in Tonkin is recorded in the first paper, and notes on the breeding habits of its possible vectors are given in the second. Larvae of *F. bancrofti* have recently been shown to complete their development in *Mansonia indiana*, Edw., and this mosquito and, in smaller numbers, *M. longipalpis*, Wulp (*annulipes*, Wlk.) are found in the delta of the Red River. Both are stated to play an important part in the transmission of *F. malayi* in the Netherlands Indies, and it is very probable that they are the vectors of *F. malayi* in Tonkin.

Although *Pistia stratiotes* is the plant usually preferred by the females for oviposition and by the larvae and pupae for breathing purposes, eggs and larvae of these two species of *Mansonia* were rarely found on it in the delta region. The larvae were, however, very common in certain breeding places on the roots of *Eichhornia* (*Pontederia*) *crassipes*. This is the more remarkable since *Pistia* is cultivated in pools within the boundaries of the villages in the neighbourhood of buffalo sheds and dwellings, whereas *Eichhornia* occurs outside and sometimes at a distance. On the other hand, eggs have never been taken on the latter and, experimentally, females did not oviposit if it alone was available. In the laboratory, development of the larvae was completed on the roots of *Pistia* and *Eichhornia*, but not on those of *Trappa bicornis*, *Azolla pinnata* and *Salvinia natans*; eggs were laid on the leaves of *Pistia*, and still more readily on those of *Salvinia*, even when the two plants were both available. In nature, numerous batches of eggs of both species were found on the leaves of *S. natans*, which is frequently more or less abundant in pools containing *E. crassipes*. These observations may be only of temporary and local application, since there is great variation from year to year in this region in climatic conditions and the appearance, extent and flora of breeding places. In 1935, larvae of *Mansonia* were found until December, whereas in the following year none was seen after October.

Yao (Y. T.) & Ling (L. C.). **Study of Mosquito Fauna in south-western China especially in the Provinces of Kweichow and Yunnan. Part I. Tribe Anophelini.**—*Jap. J. exp. Med.* **15** no. 2 pp. 121–136, 1 map, 33 refs. Tokyo, April 1937.

Between 11th May 1935 and 24th February 1936, mosquitos were systematically collected in various localities in Szechuan, Kwangsi, Kweichow and Yunnan [*cf. R.A.E.*, B **25** 99]. A list is given of the localities, showing the Anophelines taken, the date of collection, and, where possible, the breeding places of the larvae, the resting places of the adults, and the associated Anophelines. The species, in addition to those already noticed [*loc. cit.*], were *Anopheles karwari*, James,

A. annularis, Wulp, *A. annularis* var. *adiei*, James & List., *A. splendidus*, Koidz., *A. lindesayi*, Giles, *A. gigas* var. *baileyi*, Edw., and *A. culicifacies*, Giles. The forms of *A. aitkeni*, James, and of *A. jeyporiensis*, James [*cf. loc. cit.*] were var. *bengalensis*, Puri, and var. *candidiensis*, Koidz., respectively. *A. hyrcanus* var. *sinensis*, Wied., was generally distributed in all the localities visited. A classified list is given of the 22 species of *Anopheles* that have now been recorded from China.

Hu (S. M. K.) & Yu (H.). **Further Studies on the Blood Preferences of *Anopheles hyrcanus* var. *sinensis* Wied. in Shanghai Region.**—*Chin. med. J.* **51** no. 5 pp. 639–642, 5 refs. Peiping, May 1937.

Observations had shown that most of the engorged females of *Anopheles hyrcanus* var. *sinensis*, Wied., taken in dwellings in the Kaochiao district of Shanghai had fed on man [*R.A.E.*, B **24** 46], but it was not known whether this was due to a definite preference for human blood. To determine this, two experiments were carried out on the same lines as a previous one [**24** 191], except that mosquitos were collected from bedrooms and kept for only 4–5 days, since this period allowed sufficient time for the digestion of a blood meal during the warm season (July). In the first series 306 out of 318 engorged, and in the second 182 out of 203. In the precipitin tests with antisera prepared from the blood of cow, goat, pig, man, dog, cat and fowl, the percentages positive were 44·8, 23·2, 15·4, 6·9, 4·2, 2·6 and 2·9, and 31·9, 36·3, 7·7, 8·2, 10·4, 4·4 and 1·1, respectively. Thus the mosquitos showed little inclination to feed on man when domestic animals were equally available. On the whole, the blood preferences were not very different from those shown by mosquitos collected in a cow-shed [**24** 191]. The relative amount of feeding surface was again found to be unimportant in determining the choice of host. It is concluded that most of the Anophelines had not entered the bedroom in response to any inherent preference for human blood and it might, therefore, be possible to divert them from dwellings by increasing the number of animal sheds [*cf.* **24** 47].

Feng (Lan-Chou) & Ch'in (Yao-T'ing). **The Presence of *Anopheles maculipennis* in certain Parts of Manchuria.**—*Chin. med. J.* **51** no. 4 pp. 496–499, 1 pl., 12 refs. Peiping, April 1937.

In view of the conflicting reports as to the presence of *Anopheles maculipennis*, Mg., in China [*cf. R.A.E.*, B **24** 293; **17** 164], a short survey of the mosquitos of northern Manchuria was made during August 1936. *A. maculipennis* was taken in two localities in Heilungkiang; 7 females were found, 5 inside a dwelling and 1 biting a cow, and larvae were collected from a ditch of fresh water and 2 females and a male were reared from them. The adults of both sexes and the larva are briefly described from the Chinese material. The characters of the male terminalia suggest that the race is *atroparvus*, van Thiel.

Senior White (R.). **The *Anopheles sundaicus* Invasion of Lower Bengal.**—*Indian med. Gaz.* **72** no. 5 pp. 307–312, 1 map. Calcutta, May 1937.

The history of the spread of *Anopheles sundaicus*, Rdnw., in Lower Bengal since 1930 [*cf. R.A.E.*, B **20** 29; **24** 164, 257, etc.] is reviewed,

various possible causes for the extension of its distribution are suggested, notes are given on the agencies responsible for control measures in the different localities, and a plea is made for the adoption of a comprehensive irrigation and land reclamation scheme, since this is held to be the only possible means of preventing its breeding.

Roubaud (E.) & Treillard (M.). **Observations biologiques sur le biotype** *cambournaci* **de l'***Anopheles maculipennis.*—*Bull. Soc. Path. exot.* **30** no. 5 pp. 383–387, 3 refs. Paris, 1937.

A comparison of the behaviour of a strain of *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel, from la Vendée with that of strains of race *cambournaci* from Portugal [*cf. R.A.E.*, B **25** 2] and Camargue [**25** 170] indicates that the latter is more easily fertilised than the former in spaces with a cubic capacity of less than about 1·75 cu. ft. Moreover, when subjected to continuous warmth during the winter, the former shows, in the longer period it requires for the maturation of its eggs, traces of the period of asthenobiosis exhibited by it in nature, whereas the shorter period required by the latter suggests a type of hibernation dependent chiefly on temperature [*cf.* **25** 3]. These differences in behaviour confirm the validity of the distinction between these races, which was originally based on hereditary characters in the eggs.

Sautet (J.). **Contribution à l'étude de l'exophilie de l'***Anopheles maculipennis labranchiae* **et de l'***Anopheles sacharovi* **dans ses rapports avec la transmission du paludisme.**—*Bull. Soc. Path. exot.* **30** no. 5 pp. 387–392, 3 figs. Paris, 1937.

The apparently exophilous behaviour of *Anopheles maculipennis*, Mg., race *labranchiae*, Flni., and of *A. sacharovi*, Favr [*cf. R.A.E.*, B **25** 170] led to a systematic search for possible resting places outside houses and stables. The investigations, which were undertaken chiefly in September, were made on the eastern plain of Corsica in the malarious zone, most of them in the neighbourhood of a shed containing cattle that was known to be a typical resting place. The daily catches in the shed had been found to vary considerably with climatic conditions, particularly wind. Many adult Anophelines were found in the numerous tree holes in a small wood of cork oaks, as well as in deep holes in the earth between the roots. They were present in the deepest holes whatever the weather, but in shallow holes they were only found when there was no wind. In windy weather, the catches in outdoor shelters were low (being reduced to about half even in deep shelters) but were always higher in the stable. Moreover, at the end of September, adults became rare in natural shelters but continued to be numerous in the stable. The Anophelines caught in natural shelters were engorged in the same proportions as those in the stable. They attempted to bite man in the open. The males were generally more numerous in the outdoor shelters than in stables, but that was probably due to the greater proximity of breeding places. From an examination of the eggs laid by captured females it was found that, as in the stable, race *labranchiae* and *A. sacharovi* were the predominating biotypes. They seem to be easily adaptable to and may even prefer, external shelters, and during the warm weather they may be said to be amphophilous.

The capture of the mosquitos in these outdoor shelters is not easy, since they are more active there than in houses or stables. The hole should be carefully covered with a sack or sleeve opening into a cage, and the mosquitos then disturbed so that they fly into the cage. In this way, 10–30 Anophelines per hole have been caught, and the numbers of such shelters, which also include the banks of streams and the porches of houses, are sufficiently great for them to be considered of importance in relation to malaria transmission, which may take place in the open more frequently than is generally recognised.

GRUNSKE (F.). **Tätigkeit und Ergebnisse der Malaria-Untersuchungstation in Emden (Ostfriesland) von 1910–1933.** [The Activity of and Results from the Malaria Research Station at Emden (East Friesland).]—*Veröff. Marine-Sanitätsw.* **27** 180 pp., 1 map. Berlin, 1936. (Abstr. in *Bull. Inst. Pasteur* **35** no. 11 p. 563. Paris, 15th June 1937.)

An account is given of the fluctuations in the incidence of malaria in East Friesland during the past 24 years, based on data collected at the malaria research station at Emden. The disease, which is endemic benign tertian [*cf. R.A.E.*, B **22** 93; etc.], is gradually disappearing. *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel, is the most abundant Anopheline, being 23 times as numerous as race *messeae*, Flni. Race *maculipennis* (*typicus*) has not been found, and *A. claviger*, Mg. (*bifurcatus*, auct.) is rare. In the Emden district, malaria occurs in foci that develop round a gametocyte carrier; it is a house or family disease, both in the town and the country. The difficulties encountered in organising anti-malaria work are described.

HERMS (W. B.) & KADNER (C. G.). **The Louse Fly,** *Lynchia fusca*, **Parasite of the Owl,** *Bubo virginianus pacificus*, **a new Vector of Malaria of the California Valley Quail.**—*J. Parasit.* **23** no. 3 pp. 296–297. Baltimore, Md, June 1937.

Chiefly in view of the apparent scarcity of *Lynchia hirsuta*, Ferris, investigations were undertaken in California to discover other possible vectors of *Haemaproteus lophortyx*, the causal organism of malaria of quails (*Lophortyx*) [*cf. R.A.E.*, B **19** 90]. Numerous tests were made with *Anopheles maculipennis*, Mg., *Culex tarsalis*, Coq., and *Aëdes dorsalis*, Mg., but, although all three species sucked the blood of infected birds, the disease was not transmitted, except possibly in one instance with *Anopheles maculipennis*, in which case the identity of the organism remained in doubt. Positive results were, however, obtained in experiments here described with *Lynchia fusca*, Macq., taken from the owl, *Bubo virginianus pacificus*. The incubation period in the fly appeared to be from 9 to 13 days and in the quail about 25 days.

WOKE (P. A.). **Cold-blooded Vertebrates as Hosts for** *Aëdes aegypti* **Linn.**—*J. Parasit.* **23** no. 3 pp. 310–311. Baltimore, Md, June 1937.

Since the author had discovered no record of *Aëdes aegypti*, L., feeding on cold-blooded animals, he undertook experiments to determine the influence of temperature on the feeding response of this species. Of 35 females released in a cage in which there was a cold suspension of red-blood corpuscles, 23 fed within a short time; the

remainder were unresponsive, but fed immediately when offered a warm suspension. In another experiment in which cold blood plasma and blood plasma warmed to 37°C. [98·6°F.] were repeatedly offered at the same time, the mosquitos fed on the warmed preparations in preference to the cold ones [*cf. R.A.E.*, B **24** 224]. These observations suggested that differences in body temperature alone would not prevent mosquitos that normally feed on warm-blooded animals from feeding on cold-blooded ones. A frog (*Rana clamitans*) and a turtle (*Terrapene carolina*) were each introduced into a cage containing 75 mosquitos that had been maintained on sugar solution for the 5 days following emergence and then deprived of food and water for 24 hours. During a period of 3 hours, 23 and 56 took medium to full blood meals on the frog and turtle respectively, and 16 and 7 ingested a recognisable quantity of blood. Viable eggs were produced by both lots of mosquitos, and normal adults were reared from them. Later experiments have demonstrated that the nutritive value of the blood of these animals is equal, or even superior, to that of certain warm-blooded animals. Thus the blood of cold-blooded animals, though possibly not preferred to that of warm-blooded animals, may serve under certain conditions to enable the species to reproduce in nature.

WOKE (P. A.). **Comparative Effects of the Blood of Man and of Canary on Egg-production of** *Culex pipiens* **Linn.**—*J. Parasit.* **23** no. 3 pp. 311–313. Baltimore, Md, June 1937.

The experiments described were undertaken to determine whether there is any significant difference between the nutritive values for *Culex pipiens*, L., of the blood of man and of that of canary [*cf. R.A.E.*, B **22** 218]. The mosquitos used were of a strain reared from eggs collected in a stream near Baltimore, Maryland. The number of eggs produced per mg. of blood ingested served as the basis of comparison, and it was found that the females fed on canary produced an average of more than twice as many eggs per mass or per mg. blood ingested as those fed on man.

O'CONNOR (F. W.) & BEATTY (H. A.). **The Abstraction by** *Culex fatigans* **of** *Microfilaria bancrofti* **from Man.**—*J. trop. Med. Hyg.* **40** no. 9 pp. 101–103, 1 graph, 9 refs. London, 1st May 1937.

The experiments described, which were carried out in St. Croix, using *Culex fatigans*, Wied., and *Aëdes aegypti*, L., fed on man infected with *Filaria bancrofti*, confirmed the findings of other workers [*cf. R.A.E.*, B **20** 169] that *C. fatigans* is able to ingest at a single blood meal many more microfilariae than can be found in the same quantity of blood withdrawn by mechanical means (finger prick). *A. aegypti* feeding at the same time, under the same conditions, ingested a far smaller number. It is conceivable that the salivary glands of the former, which is a suitable host, contain some element that exercises a chemotactic effect on the microfilariae [*loc. cit.*], which is absent in those of the latter, an unsuitable host according to the results of the present study. Hinman, however, found no evidence of any chemotactic effect being exerted on the microfilariae of *Filaria (Dirofilaria) immitis* by the salivary secretions of *A. aegypti*, which is a suitable host for this species [*cf.* **23** 282]. The differences in the numbers of embryos in mosquitos that had ingested approximately the same amount of blood at about the same time are striking; the

mosquitos had fed at different points and a study of the variation or uniformity of distribution of the microfilariae in the skin of various parts of the body seems to be desirable. There may also be some variation in the depth to which the mouth-parts of different species and different individuals of the same species can penetrate when feeding and in the size of the vessels from which they draw blood. It is conceivable that the microfilariae may become temporarily arrested at the bends of small vessels and at junctions, and so be present in larger numbers there than in the straight parts. *C. fatigans* ingests about 1·03 cu. mm. blood, is not readily disturbed while feeding, usually bites one person only in 24 hours, and takes a full meal at one time. *A. aegypti* ingests about 1·0 cu. mm. blood, is easily interrupted, takes a number of small feeds with frequent intervals, and may bite many different persons in 24 hours. On the hypothesis of Manson (1883) that the microfilariae become " entangled " in the mouth-parts of the mosquito, it would seem reasonable that a larger number would become " entangled " in the mouth-parts of *C. fatigans* separated as they are to form a " net " over a " longer time," than would be expressed from a finger prick. Variations in the length of time of feeding would explain variations in the numbers of microfilariae abstracted by different individuals of the same species. On the other hand, *A. aegypti* feeding for short periods on many different persons is likely to obtain fewer microfilariae than the more persistent feeder.

GUIBERT (—). **Expériences de transmission de** *Trypanosoma gambiense* **de cobaye contaminé à cobaye sain par l'intermédiaire de** *Stegomyia fasciata*.—*Ann. Méd. Pharm. colon.* **35** no. 1 pp. 136–143, 4 pls., 6 refs. Paris, 1937.

The author describes experiments in which *Trypanosoma gambiense* was mechanically transmitted from infected to healthy guineapigs by the bites of single examples of *Aëdes aegypti*, L. (*Stegomyia fasciata*, F.), even when the interval between feedings was as long as an hour.

TOURNIER (—). **Les moustiques à la Guyane.**—*Ann. Méd. Pharm. colon.* **35** no. 1 pp. 227–228. Paris, 1937.

Anopheles tarsimaculatus, Goeldi, which is the only Anopheline found in the coastal region of French Guiana, is replaced 12–19 miles inland by *A. albitarsis*, Arrib., and it would appear that the former is adapted to brackish water and the latter to fresh. Since no other Anophelines have been observed, these may be considered as the principal vectors of malaria. Adults and larvae of *A. tarsimaculatus* were taken in the immediate vicinity of Cayenne in 1936. *Aëdes aegypti*, L., and a species of *Mansonia* (*Taeniorhynchus*) were collected in all the villages visited. No adult Anophelines were seen in houses in Cayenne at the edge of a marsh in which larvae were observed, but examples of *A. aegypti* were present in all. On the other hand, no examples of *A. aegypti* were found in the hydro-airport or its environs, on account of the strict observance of sanitary regulations.

[*Cimex lectularius*.]—*Verh. dtsch. Ges. angew. Ent.* **10** (1936) pp. 16–40. Berlin, 1937.

The first of this series of addresses on the problem of controlling the bed-bug [*Cimex lectularius*, L.] is by A. W. McKenny Hughes, who deals

generally with the subject in Great Britain [*cf. R.A.E.*, B **23** 141]. Others are accounts by Jencič, Jelič and L. Gassner of the use of hydrocyanic acid gas in Austria, Jugoslavia and Sweden, respectively, a survey by H. Kemper of all aspects of the question in Germany, a brief note by Thomann on methods of control in Switzerland, and an account in English by [W. C.] Gunn of the Glasgow system of supervision of re-housing schemes [**21** 268].

[**Mosquitos.**]—*Verh. dtsch. Ges. angew. Ent.* **10** (1936) pp. 40–80. Berlin, 1937.

In the first of these papers, [E.] Martini surveys various practical questions connected with the control of mosquitos in Germany. F. Peus discusses *Culex pipiens*, L., and points out that winter work against it is useful only as a supplement to summer measures [*R.A.E.*, B **23** 95]. F. Eckstein records some observations on the biology of the larvae of the races *atroparvus*, van Thiel, and *messeae*, Flni., of *Anopheles maculipennis*, Mg., as regards the condition of the surface of the water [**24** 287]. He has found that *A. claviger*, Mg. (*bifurcatus*, auct.) like *atroparvus*, is not affected by a layer of inert dust on the surface, and that the colour of the surface influences that of Anopheline larvae, almost white larvae being obtained from water dusted with french chalk and almost yellow ones from water dusted with pollen. F. Weyer discusses various points characterising the autogenous and anautogenous races of *C. pipiens* [**21** 266, etc.]. There are also a number of reports on outbreaks of mosquitos in Germany and the measures adopted against them.

Papers noticed by Title only.

Thompson (G. B.). **The Parasites of British Birds and Mammals. XV. Bird-fleas and their Hosts.**—*Ent. mon. Mag.* **73** no. 877 pp. 137–142, 1 ref. London, June 1937. **XVI. Records of Ixodoidea (Ticks).**—*T.c.* no. 878 pp. 160–162, 4 refs. July 1937.

Kishida (K.). **Notes on the Acarina Mites and Ticks, from the Peninsula of Korea and the Island of Quelpart collected in August 1936** [including *Boophilus* (*Palpoboophilus*) *minningi*, sp. n., on cattle in Korea]. [*In Japanese.*]—*Lansania* **8** no. 79 pp. 131–144, 1 fig. Tokyo, October 1936.

Cooley (R. A.). **Two new Dermacentors from Central America.**—*J. Parasit.* **23** no. 3 pp. 259–264, 1 pl. Baltimore, Md, June 1937.

Kohls (G. M.). **A new Species of Bat Flea (Siphonaptera) from Arizona.**—*J. Parasit.* **23** no. 3 pp. 300–302, 4 figs. Baltimore, Md, June 1937.

Lent (H.) & Proença (M. C.). *Cimex limai* **Pinto, 1927, parasito de morcegos no Brasil.** [*C. limai*, Pinto, a Parasite of Bats in Brazil (re-description).]—*Mem. Inst. Osw. Cruz* **32** fasc. 2 pp. 211–216, 2 pls. Rio de Janeiro, 1937. [*Cf. R.A.E.*, B **16** 152.]

Knipling (E. F.). **The Biology of** *Sarcophaga cistudinis* **Aldrich (Diptera), a Species of Sarcophagidae parasitic on Turtles and Tortoises** [in U.S.A.].—*Proc. ent. Soc. Wash.* **39** no. 5 pp. 91–101, 2 pls., 8 refs. Washington, D.C., May 1937.

Séguy (E.). **Ophthalmomyiases provoqués par les mouches** [review of the literature].—*Ann. Hyg. publ.* **15** pp. 109–120, many refs. Paris, 1937.

Roy (D. N.). **On the Function of the Pharyngeal Ridges in the Larvae of** *Calliphora erythrocephala*.—*Parasitology* **29** no. 2 pp. 143–149, 3 figs., 14 refs. Cambridge, 30th April 1937.

Keilin (D.) & Tate (P.). **A comparative Account of the Larvae of** *Trichomyia urbica* **Curtis,** *Psychodes* [*Psychoda*] *albipennis* **Zett., and** *Phlebotomus argentipes* **Ann. & Brun. (Diptera : Psychodidae).** —*Parasitology* **29** no. 2 pp. 247–258, 45 figs., 6 refs. Cambridge, 30th April 1937.

Parrot (L.) & Schwetz (J.). **Phlébotomes du Congo Belge.—VI. Trois espèces et une variété nouvelles.**—*Rev. Zool. Bot. afr.* **29** fasc. 3 pp. 221-228, 7 figs., 8 refs. Brussels, 15th June 1937.

da Fonseca (F.). **Nota sobre uma especie de** *Flebotomus* **do Brasil (Diptera. Psychodidae).** [*Phlebotomus limai*, da Fonseca 1935, described from females caught trying to bite man in the daytime in Brazil.]—*Mem. Inst. Butantan* **10** (1935–36) pp. 61–62, 2 figs. S. Paulo, 1937. (With a Summary in English.)

Pechuman (L. L.). **Notes on some Neotropical Species of the Genus** *Chrysops* **(Dipt. Taban.).**—*Rev. Ent.* **7** fasc. 2–3 pp. 134–141, 2 figs., 6 refs. Rio de Janeiro, 24th July 1937.

Philip (C. B.). **New Horseflies (Tabanidae, Diptera) from the southwestern United States.**—*Pan-Pacif. Ent.* **13** no. 1–2 pp. 64–67, 2 refs. San Francisco, Calif., 1937.

Hillman (C. C.) & Morgan (M. T.). **Tularemia. Report of a fulminant Epidemic transmitted by the Deer Fly** [*Chrysops discalis*, Will., in Utah].—*J. Amer. med. Ass.* **108** no. 7 pp. 538–540. Chicago, Ill., 13th February 1937. [*Cf. R.A.E.*, B **25** 133.]

Macfie (J. W. S.). **Notes on Ceratopogonidae (Diptera)** [including a key to the species of *Culicoides* found in Malaya and neighbouring countries].—*Proc. R. ent. Soc. Lond.* (B) **6** pt. 6 pp. 111–118. London, 15th June 1937.

Iyengar (M. O. T.). **Public Health Aspects of Filariasis in India** [discussion of distribution and review of present knowledge].—*Indian med. Gaz.* **72** no. 5 pp. 300–307, 8 figs., 9 refs. Calcutta, May 1937.

Baisas (F. E.). **Notes on Philippine Mosquitoes, VI. The Pupal Characters of Anophelines of the Subgenus** *Myzomyia*.—*Philipp. J. Sci.* **61** no. 2 pp. 205–220, 25 pls., 13 refs. Manila, October 1936. [Recd. 1937.]

Wu (Shih-cheng). **Further Notes on the Mosquitoes of Hangchow, Chekiang, with Description of one new Species** [notes on 14 additional species].—*Yearb. Bur. Ent. Hangchow* **5** (1935) pp. 46–53, 3 figs., 20 refs. Hangchow, October 1936. [Recd. 1937.]

Escherich (K.). **Die Zweiflügler (Diptera) des Waldes. Eine kurze Uebersicht.** [Forest Diptera of Central Europe. A brief Survey (including blood-sucking species.)]—*Forstwiss. Zbl.* 1937 no. 13–14 pp. 401–449, 27 figs. Berlin, 1937.

[Zolotarev (N. A.).] **Золотарев (Н. А.). Sur les espèces et la répartition géographique des tiques Ixodidae dans la R.S.S.A. du Daghestan.** [*In Russian.*]—*Trav. Inst. Méd. vét. exp. URSS* **11** pp. 128–132. Moscow, 1935. [*Cf. R.A.E.*, B **24** 53.]

[MARKOV (A. A.), BOGORODITZKIĬ (A. V.) & SALYAEV (V. A.).] **Марков (А. А.), Богородицкий (А. В.) и Саляев (В. А.). De la biologie de la tique** *Dermacentor silvarum* **Olen., 1931.** [*In Russian.*]—*Trav. Inst. Méd. vét. exp. URSS* **11** pp. 106–109, 5 refs. Moscow, 1935. (With a Summary in French.)

Observations by two of the authors on an outbreak of equine piroplasmosis in Western Kazakstan and in localities in the Middle and Lower Volga Regions in 1931 show that the vector was *Dermacentor silvarum*, Olen. [*cf. R.A.E.*, B **23** 280]. A study of the life-cycle of the tick [*cf.* **23** 140] was made in the laboratory at 20–28°C. [68–82·4°F.], starting with eggs laid between 20th May and 10th June by females collected on horses on 10th and 12th May. The larvae and nymphs were allowed to engorge on mice as soon as they were ready to do so. Under these conditions, the life-cycle was completed in a minimum period of 82 days, the larval and nymphal stages each lasting about 4 weeks. In the field, however, the life-cycle could only be completed so quickly under optimum conditions. In the central zone of the Russian Union, larvae would probably first appear in the beginning of the second half of June, nymphs in the middle of July, and adults about the middle of August. The transmission of *Piroplasma caballi* by *D. silvarum* was confirmed in an experiment in which 2 out of 3 horses were infected when subjected to the bites of adult females that were the offspring of ticks fed on infected horses. It was also shown that the females will engorge in the absence of males.

[MARKOV (A. A.) & BOGORODITZKIĬ (A. V.).] **Марков (А. А.) и Богородицкий (А. В.). Sur la biologie de la tique** *Boophilus calcaratus* **Bir.** [*In Russian.*]—*Trav. Inst. Méd. vét. exp. URSS* **11** pp. 110–114, 3 refs. Moscow, 1935. (With a Summary in French.)

Investigations in 1932 on the cattle tick, *Boophilus calcaratus*, Bir., in a locality in western North Caucasus showed that three overlapping generations were produced annually, development continuing from the beginning of April until about October. The life-cycle from egg to adult was completed in about 2 months, oviposition beginning 4–9 days after the engorged females dropped and the eggs hatching in 28–30 days. The larval and nymphal stages apparently lasted 7–8 days each, and engorged females occurred 7–8 days later. In view of the fact that the generations overlap, cattle require to be dipped frequently, especially at the time of the appearance of the larvae.

[KURCHATOV (V. I.).] **Курчатов (В. И.). L'état actuel de la question de répartition géographique de la tique** *Boophilus calcaratus* **Bir. en URSS.** [*In Russian.*]—*Trav. Inst. Méd. vét. exp. URSS* **11** pp. 115–123, 11 refs. Moscow, 1935. (With a Summary in French.)

Data on the distribution of *Boophilus calcaratus*, Bir., in the Russian Union are summarised, and a brief survey is given of the characters of the areas in which it is found. It occurs only in the southern zone, the northern limit of its range being 48–49°N. Lat. in the Ukraine, 45–49° in North Caucasus, 44–45° in Daghestan, 38–40° in Turkmenistan, and 43–44° in southern Kazakstan. As a moist climate combined with high temperature is indispensable for it, it is usually present in forest or semi-forest land at the foot of mountains or in

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mountainous regions up to 2,600 ft., in semi-steppe areas and in land covered with brushwood. In the steppes and arid zones it only occurs under the cover of trees, brushwood or tall grasses close to water. It is most numerous and widely distributed in the southern part of North Caucasus, becomes progressively less so in Transcaucasia, Uzbekistan, Crimea and Tadzhikistan, and is rare elsewhere. Cattle diseases caused by *Piroplasma bigeminum*, *P. major* (*Françaiella colchica*) and *Anaplasma rossicum* are frequent in infested localities, and in North Caucasus outbreaks occur in years having a wet spring and summer. The distribution and abundance of *B. calcaratus* are greatly influenced by the numbers of cattle present, the length of time they remain in a pasture, and the frequency with which they are driven to and from it, as in many instances they carry ticks with them to uninfested ground.

[KOCHETKOV (A. V.).] **Кочетков (А. В.). Les tiques de la famille Ixodidae au Transoural.** [*In Russian.*]—*Trav. Inst. Méd. vét. exp. URSS* **11** pp. 124–127, 2 refs. Moscow, 1935. (With a Summary in French.)

In the central Transural region, domestic animals are severely infested with ticks from April to the end of October and equine piroplasmosis is common. A study was therefore made of collections of ticks taken in 22 districts in 1932 and 1933 on various domestic animals and a few wild ones. The ticks collected were *Ixodes ricinus*, L. (an editorial foot-note suggests that this species was mis-identified and was in fact *I. persulcatus*, P. Sch. [*cf. R.A.E.*, B **23** 75]), *Dermacentor marginatus*, Sulz., *D. silvarum*, Olen., *Hyalomma volgense*, Sch. & Schl., and *Rhipicephalus bursa*, C. & F. The last two were rare. *D. marginatus* and the species of *Ixodes*, which was the most abundant, were chiefly found in the north-eastern zone, which is to a large extent covered with forests of deciduous trees. *Ixodes* occurred on the animals uninterruptedly from spring to the end of the summer ; *D. marginatus* did so from early spring to the end of June, and again from August to the end of October, infestation by it coinciding with outbreaks of equine piroplasmosis. Owing to the wet summer and autumn of 1932, *D. marginatus* was abundant on horses, cattle, sheep and dogs in the central forest-steppe zone. *D. silvarum*, which markedly increased in numbers, decidedly predominated in the relatively waterless south-eastern forest-steppe zone and was practically the only tick in the dry steppe in the south of the region.

[OLENEV (N. O.).] **Оленев (Н. О.). Un nouveau foyer de tiques *Ornithodorus* au Kazakstan du sud-est.** [*In Russian.*]—*Trav. Inst. Méd. vét. exp. URSS* **11** pp. 133–135. Moscow, 1935. (With a Summary in French.)

In 1930–31, an important focus of *Ornithodorus lahorensis*, Neum., was found in a locality in the Katu-tau mountains [between 44 and 45° N. Lat. and 78 and 80° E. Long.] having average January and July temperatures of about −5°C. [23°F.] and 27°C. [80·6°F.], respectively, and a mean annual rainfall of about 12–16 ins. No species of the genus in the eastern hemisphere has previously been found so far to the north-east.

The ticks were collected in sheep folds that are used in winter, the flocks pasturing in the mountains in summer. They were most

abundant from the beginning of December, when the temperature dropped to −30°C. [−22°F.], to the end of March, the numbers per sheep varying from one to 50 or more. They apparently transmitted a disease that was often fatal, as many as 50 per cent. of the sheep in some folds dying in the winter of 1930–31 [*cf. R.A.E.*, B **23** 91]. The rate of mortality was considerably reduced in 1931–32 by control measures, chiefly the application of various dressings by hand.

[TZAPRUN (A. A.).] **Цапрун (А. А.). Biologie de l'oestre du dromadaire** *Cephalopsis titillator* **Cl.** [*In Russian.*]—*Trav. Inst. Méd. vét. exp. URSS* **11** pp. 136–151, 16 refs. Moscow, 1935. (With a Summary in French.)

In western Kazakstan, severe injury is caused to camels by the Oestrid, *Cephalopsis titillator*, Clark, and investigations on its bionomics were therefore carried out in 1933 in a locality about 90 miles south of Uralsk. All stages are described in detail. The adults occur from the end of May to the beginning of October ; they are active on calm, dry and sunny days, but not in dull, cold or windy weather, unless it is protracted. In the laboratory, they lived 4–16 days. The ovaries of a mature female contained 800–900 eggs. While on the wing, the female injects a batch of larvae into the nostrils of a camel from a distance of about ½ inch. The larvae penetrate into the nasal passages, some eventually reaching the naso-pharynx, and their presence disturbs the breathing of the camel and causes great suffering. In one instance, as many as 165 larvae were found in one camel, of which 64 completely blocked the naso-pharynx. After remaining in the host for 10–11 months, the larvae drop to the ground between early spring and September and burrow at once into the soil as far down as the upper loose layer permits, which in the steppes of western Kazakstan is usually less than an inch. They pupate in about 1½ days, and the adults emerge some 25 days later. If the larvae are unable to burrow into the soil, they pupate on the surface, but pupation is protracted and fewer adults emerge. Exposure to direct sunlight prevents pupation, and excessively damp soil retards it and may cause the puparia to decay. In experiments on the effect of cold, larvae pupated after having been kept in an ice-cellar for 5 days, but the puparia were abnormal and no adults emerged, while of 3 pupae so treated, 2 gave rise to adults.

CAMERON (A. E.). **Insects and other Pests of 1936.**—*Trans. Highl. agric. Soc. Scot.* 1937 repr. 47 pp., 21 figs., 23 refs. Edinburgh, 1937.

In the course of this report, notes are given on the morphology, bionomics and seasonal occurrence of *Hypoderma diana*, Br., *Cephenomyia auribarbis*, Mg., *Liptoptena cervi*, L., *Trichodectes cervi*, L., and *Ixodes ricinus*, L., all found on red deer (*Cervus elaphus*) in Scotland [*cf. R.A.E.*, B **20** 179].

THOMSON (R. C. M.). **Observations on the Biology and Larvae of the Anthomyidae.**—*Parasitology* **29** no. 3 pp. 273–358, 157 figs., 24 refs. Cambridge, 5th July 1937.

This account of the habits and activities of the adults of a number of species of Muscoid flies, and of the course of development and

morphology of their larvae is based on investigations carried out for several years in the west of Scotland. The species dealt with include *Haematobia stimulans*, Mg., and *Stomoxys calcitrans*, L., the only two blood-sucking flies found in Ayrshire, and *Morellia simplex*, Lw. The last is of some economic importance, since it causes intense irritation to horses and cattle by swarming on the face, to which it appears to be mainly attracted by the moist secretion from the eye. It is especially troublesome in early summer and, so far as cattle are concerned, it is of greater importance than *Haematobia* during June and July.

Adults of both sexes of *Haematobia* are common on cattle in the fields from June until the end of September, and apparently feed almost exclusively on these animals. They seem to follow them closely and were never seen in the empty byres during the day. They were not observed on horses and were never known to bite man. In nearly every case, they congregate on the part of the body above the forelegs; they do not occur on the head or at the base of the horns, or on the hind part of the body within reach of the tail. At no time, however, were they so numerous as to cause extreme annoyance; 25 was the highest number seen on a single cow. Engorged adults frequently rest on wooden gates and palings round fields where cattle are grazing. Oviposition is almost entirely restricted to newly dropped cow-dung. Eggs are deposited singly, not more than 5 being laid on each pad of dung.

Stomoxys is a domestic fly that is never found at any great distance from farms and rural houses. It is one of the most numerous flies in the farmyard from the beginning of June to the middle of October. In late summer, and especially during September, it congregates on barn doors next to the farm midden. It commonly attacks man both indoors and out. It is especially troublesome towards the end of the season, and is found in houses until the end of November. During the winter, it may occasionally be seen in byres, but it is not plentiful until April. It bites cattle in the sheds and does not follow them into the fields. It was never seen on gates or fences round fields, or on dung pads. It was not abundant in stables and preferred cow-sheds. The author's observations indicate that the ovipositing habits are remarkably constant and that the type of material selected differs from that usually described. The materials in dung heaps vary in consistency from the fresh byre and stable manure added every day to caked slabs that have been baked dry by months of exposure to the sun, and it is only in cracks in these hard, apparently unattractive banks of the dung heap that females have been seen to oviposit. A gravid female was found to contain more than 90 eggs, whereas females of *Haematobia* contained only 25–29. In September, the larvae may be found in all parts of the dung heap, except in pure cow manure, dung kept porous by being mixed with straw being particularly favourable.

Thomsen (E.) & Thomsen (M.). **Ueber das Thermopräferendum der Larven einiger Fliegenarten.** [On the Temperature Preferendum of the Larvae of some Flies.]—*Z. vergl. Physiol.* **24** no. 3 pp. 343–380, 19 figs., 1 p. refs. Berlin, 1937.

This account of investigations at Copenhagen on the temperature preferences of larvae of *Musca domestica*, L., *Stomoxys calcitrans*, L.,

Haematobia stimulans, Mg., and *Lyperosia irritans*, L., is prefaced by notes on published work on this subject and by a description of the technique employed and the specially constructed temperature gradient apparatus in which the larvae could move freely in dung with a temperature range from 9 to 50°C. [48·2 to 122°F.]. The results are recorded in detail.

Larvae of *M. domestica* in horse-dung showed a definite temperature preference, which varied with their age. Larvae that were feeding preferred temperatures between 30 and 37°C. [86 and 98·6°F.]; those ready to pupate low ones below 15°C. [59°F.]. Supplementary experiments indicated that the attraction of the larvae to a given zone of the dung layer depended not solely on its temperature, but also on a chemical change there, as indicated by smell. This chemotaxis was particularly marked only during the second day of larval life. The temperature preference shown by the feeding larvae corresponded to that found in their natural habitat in a fermenting manure heap. It is concluded that the vertical distribution and movements of the larvae in natural conditions depend chiefly on their temperature preference and to a less degree on chemotaxis. It is possible that negative phototaxis, hygrotaxis and thigmotaxis also are involved.

Larvae of *S. calcitrans*, which live in litter containing cow-dung at 20–30°C. [68–86°F.], had a preferendum between 23°C. [73·4°F.] and 26°C. [78·8°F] or possibly 30°. Larvae of *H. stimulans*, which are found in cow-dung in spring and autumn, had a preferendum between 15 and 26°C. [59–78·8°F.], whereas those of *L. irritans*, which are also found in cow-dung, but only in summer, had a much higher preferendum, between 27 and 33°C. [80·6–91·4°F.].

Kobayashi (H.) & Mizushima (H.). **The Relationship between the Laboratory Temperature and the Development of Flies.**—*Keijo J. Med.* **8** no. 1 pp. 19–39, 3 figs., 17 refs. Keijo, 20th April 1937.

During the three years 1932, 1934 and 1935, data were obtained on the length of the life-cycle from oviposition to adult emergence of 1,533 examples of *Musca domestica*, L., 142 of an undetermined species of *Sarcophaga* and 139 of *Muscina stabulans*, Fall., at different mean daily laboratory temperatures.

The following is taken from the authors' conclusions: The relationship between the mean laboratory temperatures (x) and the length of development in days (y) of *M. domestica*, *Sarcophaga* sp., and *M. stabulans* can be expressed very satisfactorily by a hyperbola of the following formula: $y = a \div (x - \alpha)^b$, where α = threshold temperature, and a and b are constants. For the three flies, respectively, the figures for α (expressed in Centigrade degrees) are 12, 8·5 and 5, for a 126·795, 310·857 and 361·235, and for b 0·96921, 1·05268 and 1·05808. Janisch's catenary curve [*cf. R.A.E.*, A **25** 387, etc.] expresses the relationship well in the case of *M. stabulans* only.

Mönnig (H. O.). **A new Fly Repellent and a Blowfly Dressing. Preliminary Report.**—*Onderstepoort J.* **7** no. 2 pp. 419–430, 1 fig., 1 ref. Pretoria, October 1936. [Recd. July 1937.]

Khaki bush (*Tagetes minima*), which is a common weed in most parts of South Africa, contains a strong-smelling volatile oil (or rather

mixture of oils) in its leaves, flowers and seeds ; this can be recovered by steam distillation, the yield being about 0·5 per cent. of the total weight. Preliminary tests with baits treated with this oil showed that it was very repellent to blowflies, and further tests in an olfactometer (the construction and use of which are outlined) confirmed this finding. Experiments were subsequently undertaken in the laboratory and on sheep, in which carbon tetrachloride and other larvicides were tested in various proportions and with various emulsifiers, either with or without the addition of *Tagetes* oil, in an endeavour to discover a satisfactory dressing for sheep infested with blowfly larvae. The most satisfactory mixture contained 20 per cent. carbon tetrachloride, 5 per cent. *Tagetes* oil, 6 per cent. wool-grease, and water. The emulsion is made as follows : 200 cc. CCl_4, and 50 cc. *Tagetes* oil are mixed in one flask, 700 cc. water is measured into another, and 60 gm. wool-grease into a third. About 20 cc. of the CCl_4 and oil mixture and 100 cc. water are added to the wool-grease and the whole is shaken or stirred to emulsify it ; then more water is added and, if necessary, further small quantities of the CCl_4 mixture, up to 60 cc. ; the emulsion is again shaken and more water added until it has all been used ; the rest of the CCl_4 mixture is then incorporated. As wool-grease contains small quantities of free acid (which would prevent the emulsion from keeping well), about 10 drops of phenolphthalein is added and the emulsion neutralised with a small quantity of 10 per cent. sodium hydroxide solution. After a few days, the pink colour of the indicator may disappear, owing to the liberation of further small quantities of acid, and sufficient alkali should again be added to neutralise the emulsion ; or sufficient may be added the first time to give a more definite pink colour. As different samples of wool-grease vary in acid content, the necessary amount of sodium hydroxide solution cannot be definitely stated, but about 12 cc. per litre is an average quantity. The larvicidal effect of the emulsion is very satisfactory, it has little, if any, irritant effect on the sheep, and there is no sign of interference with the healing of the wound. Fairly high numbers of moderate to very large wounds were treated, and no re-infestation occurred except in a sheep that was prostrate and repeatedly wetted by rain, in which re-infestation took place 5 days after the first treatment. The emulsion breaks soon after it is applied, the larvae are killed within a minute, and the carbon tetrachloride and water evaporate fairly soon. The wool-grease and *Tagetes* oil settle in the wool surrounding the wound and the smell of the oil is evident for 10–14 days. The wound is usually dry after 24 hours and heals rapidly.

MACKERRAS (I. M.). **Sheep Blowfly Investigations : Some further Observations on the Mules Operation.**—*J. Coun. sci. industr. Res. Aust.* **10** no. 2 pp. 96–100, 2 pls., 4 refs. Melbourne, May 1937.

An account is given of further observations on the effect of Mules' operation on Merino sheep in Australia [*cf. R.A.E.*, B **23** 160, 294], which again show that breech conformation is much improved and the incidence of infestation by blowflies reduced. It is clear, however, that other measures must be used to supplement this treatment. It must be left to stud and flock masters to decide whether the elimination of wrinkles in the breech is best achieved by operation or by selective breeding.

Hindmarsh (W. L.). **Bag Shelter Moths on Myall Foliage cause Mortality in Sheep.**—*Agric. Gaz. N.S.W.* **48** pt. 6 pp. 317–318, 2 figs. Sydney, June 1937.

In the Forbes district of New South Wales, 20 out of 300 sheep died after being fed on loppings from weeping myall (*Acacia pendula*), which is recognised as a good fodder for use during times of drought. The trees were heavily infested with the Notodontid, *Ochrogaster* (*Teara*) *contraria*, Wlk. Examination of the dead sheep revealed the presence in the abomasum of a number of rounded, fibrous balls (the largest of which was about an inch in diameter), which were found to consist of fibres and particles from the bag shelters of the larvae. Some of the balls had passed into the intestine and, moving slowly on account of their size, had caused injury to the bowel walls. As a result of the size of the balls and the accompanying inflammatory swellings, the bowels became blocked and the sheep died. It is probable that the inflammatory changes were in part caused by the presence in the bags of the extremely irritating hairs of the caterpillars.

Van Hoof (L.), Henrard (C.) & Peel (E.). **Influences modificatrices de la transmissibilité cyclique du** *Trypanosoma gambiense* **par** *Glossina palpalis.*—*Ann. Soc. belge Méd. trop.* **17** no. 2 pp. 249–272, 9 refs. Brussels, 30th June 1937.

Details are given of a number of experiments carried out at Leopoldville on the infectivity to *Glossina palpalis*, R.-D., of various strains of *Trypanosoma gambiense* ; dissection showed that the rates were far higher when the flies fed on the infected animal were freshly emerged than when they had previously taken one or more blood meals on uninfected guineapigs, monkeys or fowls. Moreover, the rates in freshly emerged flies were higher when the infecting feed was taken on *Cercocebus galeritus agilis* than when it was taken on guineapigs, even though the latter were infected with the same strain of the trypanosome and the experimental conditions were identical. This would appear to be due not to a change in the nature of the trypanosome but rather to a difference in environment that favourably or unfavourably affects its natural development. It seems possible that the blood of *Cercocebus* monkeys produces in the body fluids of the fly conditions more favourable than those produced by that of man, guineapigs or *Cercopithecus* monkeys. The trypanosome is apparently well adapted to *Cercocebus*, since it is far less pathogenic to it than to guineapigs.

[Hargreaves (H.).] **Annual Report of the Government Entomologist for 1936.**—*Rep. med. Dep. Uganda 1936* pp. 79–80. Entebbe, 1937.

A tsetse-fly survey covering a large part of the Gulu district of Uganda was carried out during the year. Fly counts were made along streams at intervals, a look-out was kept on ridges, especially in wooded areas, and a search was also made in a number of places where true forest occurred away from streams. With the occasional exception of a fly that had obviously followed the surveying party, no examples of *Glossina palpalis*, R.-D., were found away from streams, and in most parts of the areas surveyed its density was low. It was found in small numbers along a part of a stream that was practically treeless, but was bordered by elephant grass so tall that it almost formed a roof over the stream. The standard clearings for

fords and watering places in this district were found to be adequate, but the danger of inadequate clearings was demonstrated by the fact that, on all streams examined, the concentrations of fly were higher at points where there were natural breaks in the fringing trees than at points where the fringe was continuous. Old clearings that had been abandoned for some years were found to be in surprisingly good condition, but were rendered ineffective by the growth of tall grass and a few bushes.

In the course of the tsetse surveys, an inadequate survey was also made of the rats and fleas of the same area. *Mus* (*Rattus*) *rattus* appears to be absent except in the south-east of the district. The only species of *Xenopsylla* observed was *X. cheopis*, Roths., which was widely distributed.

Aëdes aegypti, L., occurs at all stations from which material was submitted by medical officers. A brief survey of Bubilabi Ridge revealed the presence of larvae of *Anopheles funestus*, Giles, *A. gambiae*, Giles, *A. marshalli*, Theo., and *A. demeilloni*, Evans; adults of the first two species were abundant in huts and those of the third, which is also a proved vector of malaria, were found in some numbers in the rest-house.

CORSON (J. F.). **Further Observations on a Strain of** *Trypanosoma gambiense*.—*Ann. trop. Med. Parasit.* **31** no. 2 pp. 275–283, 5 refs. Liverpool, 13th July 1937.

Details are given of further observations on the same strain of *Trypanosoma gambiense* made during the 8 months following the experiments already described [*R.A.E.*, B **25** 104]. The strain continued to be maintained in monkeys and transmitted by means of *Glossina morsitans*, Westw.; three more passages were made and an additional eighth passage. The infections produced were of the same chronic type as in the monkeys used previously. Thus, the transmissibility of the strain had not apparently increased. In series of subinoculation experiments in laboratory animals there was no indication that a general increase in virulence had developed.

The impression given by these observations and others on a strain of *T. rhodesiense* in rats is that, whatever may be the relationship between *T. gambiense* and *T. rhodesiense*, a typical strain of either does not easily change so as to resemble the other. It may be that different strains of one species (using the word species for convenience) also retain their mild or virulent character firmly, but there are instances of mild strains of *T. brucei* developing increased general virulence and retaining it. Moreover, the history of trypanosomiasis in east Africa, which is briefly reviewed, also suggests that the three species of polymorphic trypanosomes do not, at least easily, change so as to resemble one another.

FAIRBAIRN (H.). **The Infectivity to Man of a Strain of** *Trypanosoma rhodesiense* **transmitted through Sheep by** *Glossina morsitans*, **and its Resistance to Human Serum** *in vitro*.—*Ann. trop. Med. Parasit.* **31** no. 2 pp. 285–291, 7 refs. Liverpool, 13th July 1937.

The strain of *Trypanosoma rhodesiense* that was used in previous experiments [*R.A.E.*, B **24** 217] and has continued to be maintained in sheep by cyclically infected examples of *Glossina morsitans*, Westw.,

was still infective to man 22 months after isolation. Cyclical transmission of the strain did not appear to have any influence on the action on it of human serum *in vitro*.

GIBBINS (E. G.). **Notes on Ethiopian Simuliidae. I.**—*Ann. trop. Med. Parasit.* **31** no. 2 pp. 299–302, 2 figs., 5 refs. Liverpool, 13th July 1937.

A small collection of Ethiopian Simuliids in the possession of the Liverpool School of Tropical Medicine was examined by the author. One species from the Victoria Falls, Rhodesia, is here described as *Simulium arnoldi*, sp. n., and two from Nyasaland, which had previously been identified by Roubaud as *S. latipes*, Mg., and *S. pusillum*, Fries [*R.A.E.*, B **2** 36] and labelled as varieties of these species, proved to be *S. nigritarsis*, Coq., and *S. hargreavesi*, Gibbins, which have not previously been recorded in the Protectorate.

BARANOV (N.). **K poznavanju golubačke mušice V. (Studij epidemiologije golubačke mušice na invaziji g. 1936.)** [Contribution to the Knowledge of the Golubatz Fly. V. (Study of the Epidemiology of the Fly in 1936.)] [*In Serbian.*]—*Vet. Arhiv* **7** no. 5 pp. 229–276 13 maps, 1 ref. Zagreb, 1937. (With a Summary in German.)

Observations on the bionomics of *Simulium columbaczense*, Schönb., were continued in the Province of Morava in north-eastern Jugoslavia in 1936 [*cf. R.A.E.*, B **24** 276]. The first adults emerged unusually early, in the beginning of April, which was probably due to the effect of the preceding mild winter and the steady fall in water level of the Danube in March. There was no severe outbreak, however, as the flies appeared and migrated in three distinct waves interrupted by spells of unfavourable weather with rain and wind. The first migration occurred in mid-April, when the flies spread to a distance of about 60 miles south from the Danube, and then gradually disappeared ; the second took place between 25th April and 1st May, the flies spreading to the south for about 90 miles ; and the third between 10th and 15th May, the flies moving west for about 60 miles. From the investigations of recent years, the author concludes that an outbreak of this Simuliid begins with a mass-emergence of the adults, which at first keep near their breeding places in spots offering the most favourable ecological conditions. As further adults emerge and the area becomes overcrowded, they gradually spread over other districts, this being the second phase of the outbreak ; the third phase consists in the formation of swarms of the flies high in the air above the breeding places ; and the fourth and most important phase is characterised by the active and partly passive migration of the flies high in the air to new areas situated as far as 60–160 miles from the Danube, where they attack cattle [*cf.* **22** 204]. A comparison of the factors associated with the severe outbreak in 1934 and the slight one in 1936 confirmed the view that an outbreak will become serious only if there is a conjunction of a low water level in the Danube, high air and water temperatures, the absence of rain and strong wind, moderate cloudiness and high air pressure. It appears that the emergence of the adults begins at 12·5–13°C. [54·5–55·4°F.], but higher temperatures are required for mass-emergence.

The examination of the stomach contents of the small sturgeon, *Acipenser ruthenus*, is of great value in tracing the breeding places of

S. columbaczense, as this fish feeds chiefly on the larvae of the fly [*cf.* **24** 276], and in the spring is found in the same places.

A section of over ten pages (254–265) is devoted to the classification of the Simuliids found in Jugoslavia ; 4 new species, 5 new subspecies, and 10 new forms are described.

Mlinac (F.) & Oswald (B.). **Preliminary Studies on the Poison contained in the Eggs of the Tick,** *Boophilus calcaratus balcanicus* **(Minning), tested on Guineapigs.** [*In Serbian.*]—*Vet. Arhiv* **7** no. 6 pp. 277–297, 2 figs., 30 refs. Zagreb, 1937. (With a Summary in English.)

Investigations on the poisonous properties of the eggs of ticks found in Jugoslavia [*R.A.E.*, B **24** 246] were continued in the autumn of 1936. The study was undertaken in view of the heavy losses among domestic animals caused in southern Serbia in the autumn of 1935 by tick-paralysis, which was responsible for the death in a single district of 529 cattle, 1,383 sheep and 1,464 goats. The tick used in the tests described was *Boophilus calcaratus balcanicus*, Minn. ; engorged females were collected on cattle and an extract prepared from eggs they laid in the laboratory. When inoculated subcutaneously into the dorsal part of the neck of 25 healthy guineapigs, the extract produced paralysis in all of them in 1–2 days, and all but one died in 3–6 days. No paralysis was, however, produced in guineapigs by inoculation of blood from the dead individuals.

Donatien (A.) & Lestoquard (F.). **Transmission naturelle d'***Eperythrozoon wenyoni* **par une tique du genre** *Hyalomma*.—*Bull. Soc. Path. exot.* **30** no. 6 pp. 459–460, 2 refs. Paris, 1937.

The adults of an undetermined species of *Hyalomma* from Persia [*cf. R.A.E.*, B **25** 123], which had fed in the larval-nymphal stage on Persian cattle infected with *Theileria dispar*, not only transmitted *Rickettsia bovis* [*loc. cit.*] to cattle, but also *T. dispar* and *Eperythrozoon wenyoni*. The last-named parasite was not observed in all subinoculated cattle, but was visible in the course of development of acute attacks of *T. dispar*.

Rastégaieff (E.). *Dermacentor silvarum*, **vecteur des hémoparasites du mouton :** *Anaplasma ovis* **et** *Theileria recondita*.—*Bull. Soc. Path. exot.* **30** no. 6 pp. 479–480. Paris, 1937.

Larvae from eggs laid by females of *Dermacentor silvarum*, Olen., taken in the Ukraine in the spring of 1936 on sheep infected with *Anaplasma ovis* and *Theileria ovis* (*recondita*) were reared to the adult stage on mice and guineapigs. In the autumn, the adults engorged on a goat, and 4–5 days later both species of parasites were observed in its peripheral blood.

Roubaud (E.) & Colas-Belcour (J.). **Nouvelles recherches sur l'évolution expérimentale de** *Dirofilaria immitis* **chez quelques culicides indigènes.**—*Bull. Soc. Path. exot.* **30** no. 6 pp. 480–484, 1 fig., 8 refs. Paris, 1937.

In the experiments described, females of *Aëdes geniculatus*, Ol., *A. punctor*, Kby., and *Anopheles plumbeus*, Steph., were fed on dogs

infected with *Filaria* (*Dirofilaria*) *immitis.* French strains of both the mosquitos and the *Filaria* were used. The infectivity of the blood had been proved by the infection of known vectors, and the number of microfilariae present was sufficiently small to prevent the premature death of the mosquitos from a too intense infestation. The parasites completed their development in the two species of *Aëdes*, the infective stage being found in the labium. In *Anopheles plumbeus*, they were only found in the malpighian tubes, so that although development may ultimately be completed, it is slower and less certain. The authors suggest that the high mortality of the mosquitos, which could not have been due chiefly to a superabundance of parasites, was a result of the injury to the malpighian tubes caused by the development in them of the microfilariae ; such development was observed in all three species, but is particularly injurious in *A. plumbeus* on account of its small size. The areas of distribution of these mosquitos and of *F. immitis* are believed to coincide in some parts of Europe. It is pointed out that although adults of the two species of *Aëdes* are occasionally found in houses, they are usually associated with trees, often in places where hunting dogs, which are said to be more frequently infested than others, are most likely to be exposed to bites. It is concluded that they may occasionally be vectors of the disease.

SCHWETZ (J.). *Trypanosoma suis* **Ochmann, 1905,** *Trypanosoma porci* **Schwetz, 1932 ou** *Trypanosoma simiae* **Bruce, 1912 ? A propos de la nomenclature de la trypanosomiase virulente du porc.**—*Bull. Soc. Path. exot.* **30** no. 6 pp. 501–511, 17 refs. Paris, 1937.

The author discusses in detail the identity of the polymorphic trypanosome causing acute trypanosomiasis of pigs in tropical Africa [*cf. R.A.E.*, B **24** 143], and concludes that it is *Trypanosoma suis*, of which *T. simiae*, *T. rhodhaini* and *T. porci* are synonyms.

ROUBAUD (E.). **Nouvelles recherches sur l'infection du moustique de la fièvre jaune par** *Dirofilaria immitis* **Leidy. Les races biologiques d'***Aëdes aegypti* **et l'infection filarienne.**—*Bull. Soc. Path. exot.* **30** no. 6 pp. 511–519, 1 fig., 9 refs. Paris, 1937.

An account is given of further experiments on the development of *Filaria* (*Dirofilaria*) *immitis* in *Aëdes aegypti*, L. [*cf. R.A.E.*, B **25** 124]. When mosquitos of the strain from Cuba, in which no development of the parasite had previously taken place, were fed on two other infected dogs, the percentages in which at least some of the microfilariae transformed into larvae were 28·5 and 65, respectively. It would appear that the susceptibility of the mosquitos decreased with the age and intensity of the infection. Experiments in which the susceptibility of the strain from Cuba was compared with that of strains from Tanganyika and Assam fed on the same two dogs showed that development took place in all the females of the last two strains. These results indicate that there are different races of *A. aegypti*. In order to determine whether the refractoriness of the Cuban strain was a racial character, the susceptibility of the progeny of a cross between males of the Cuban strain and females of the Assam strain was tested, and development was found to be at least partly arrested in 40 per cent. of the mosquitos. Development of the parasite was also observed in several females of *A. albopictus*, Skuse, from Indo-China fed on one of the dogs used in these experiments [*cf. loc. cit.*].

[Simić (Ch.).] Simitch (T.). **Etude sur la malaria dans la Serbie du sud.**—*Bull. Off. int. Hyg. publ.* **29** no. 5 pp. 919–945, 1 ref. Paris, May 1937.

In this further part of a paper on malaria in southern Serbia [*cf.* *R.A.E.*, B **25** 33], the author discusses the measurement of the variation in the amount of malaria according to locality, season and year, by means of the spleen and parasite rates among school children. He emphasises the necessity for carrying out the examinations in the same way, under the same conditions and at the same time of the year, and concludes that the amount of malaria in a locality where it is endemic is best estimated from examinations made in September or October, because both spleen and parasite rates are highest during this period. The fact that there was a rapid increase in the amount of malaria in some localities in 1935, whereas in others there was a fall, is not difficult to explain when the direct relation of these phenomena to the numbers and duration of activity of the Anopheline vectors is considered, and further that these latter factors are themselves related to climatic conditions [*cf. loc. cit.*].

Komp (W. H. W.). **Notes on the Identification of** *Anopheles pseudopunctipennis* **Theobald (Diptera, Culicidae).**—*Proc. ent. Soc. Wash.* **39** no. 6 pp. 157–163, 2 pls., 10 refs. Washington, D.C., June 1937.

The author discusses characters in the larva and in the terminalia of the male of *Anopheles pseudopunctipennis*, Theo., that are of value for purposes of identification.

[Vasil'ev] Wassilieff (A.) & Ristorcelli (A.). **L'anophélisme dans la région de Nefzaoua.**—*Arch. Inst. Pasteur Tunis* **26** no. 2 pp. 269–287, 1 pl., 1 map. Tunis, June 1937.

Details are given of an Anopheline survey carried out in the Nefzaoua region of Tunisia for a year from March 1936. In this desert region there is an abundance of water close to the surface of the soil. A total of 2,609 Anopheline larvae was taken in 40 different breeding places. Natural collections of water, such as streams in mountain valleys and springs, represented about a third of these, and the rest were artificial collections formed in ill-kept drains and ditches, or by the overflow from artesian wells, or by seepage into stone quarries, clay pits and holes dug for planting palm trees. The water in nearly all the breeding places was brackish, containing up to 32 gm. NaCl per litre. *Anopheles multicolor*, Camb., which breeds only in brackish water, was everywhere the most abundant Anopheline and must be considered the chief vector of malaria ; the other species, *A. hispaniola*, Theo., and *A. algeriensis*, Theo., both of which bred in fresh or only slightly brackish water (0·5 gm. per litre), were rare and can only be of secondary importance. *A. maculipennis*, Mg., was not found by the author and has only once been observed in the Nefzaoua region. The largest numbers of natural breeding places occurred on the northern slope of the Djebel Tebaga ; *A. multicolor* was the only Anopheline taken in them, and it is suggested that, with its long range of flight, it has spread from this mountain chain over the rest of the region.

It was noted that on cold days or on days when the wind scattered sand over the water, it was impossible to catch larvae of *A. multicolor*

from the surface of breeding places, but if the net was dragged along the bottom, large numbers were found in the mud. The mud is composed of particles of quartz mixed with unicellular algae, and it appears that, by utilising the oxygen given off by these plants, the larvae are able to remain for long periods in the mud without coming to the surface to breathe.

SYMES (C. B.). **Les insectes dans les aéronefs.**—*Bull. Off. int. Hyg. publ.* **29** no. 6 pp. 1150–1157. Paris, June 1937.

This paper is the outcome of a discussion with the Director of the Imperial Airways Company for east and central Africa of the problems of the transport of insects in aircraft. The possible means by which insects, particularly the mosquito vectors of yellow fever, malaria and dengue, may enter aeroplanes and hydroplanes, and the measures that may be used to prevent their entry or to destroy those that succeed in entering are discussed in detail. The principal measure recommended is that of spraying the interior of the aeroplane immediately after departure from an airport with a mixture of 1 part of a standard concentrated extract of pyrethrum, 16 parts of a good quality white kerosene, and 68 parts of carbon tetrachloride.

In an appendix, the disadvantages of the ordinary pyrethrum-kerosene sprays and the advantages of the spray recommended are briefly reviewed. The latter does not irritate the mucous membranes of the persons present during fumigation, its inflammability is greatly reduced owing to its low content of kerosene, and because its pyrethrum content is constant, it is effective. On the other hand, it is about ten times as expensive.

DE BOER (H.). **Mesures antimoustiques aux aérodromes. Désinfestation des aéronefs en Ouganda.**—*Bull. Off. int. Hyg. publ.* **29** no. 6 pp. 1157–1158. Paris, 1937.

The aerodrome at Entebbe is at present the only fixed stop in Uganda for aeroplanes on the regular inter-territorial service. The measures taken to prevent the transport of mosquitos by aeroplane at this port and those that will be taken at Laropi and Port Bell, the projected ports of call for the new hydroplane service, are briefly reviewed.

Informations sur le degré d'infestation des pays d'Afrique par les moustiques vecteurs de la fièvre jaune.—*Bull. Off. int. Hyg. publ.* **29** no. 6 pp. 1159–1185, 1 ref. Paris, June 1937.

This is a collection of reports from the Belgian Congo and from British and French colonies, protectorates and mandated territories in tropical Africa on the occurrence in them of *Aëdes aegypti*, L., and, in some cases, of other mosquitos that may possibly be vectors of yellow fever.

WILLIAMSON (K. B.) & ZAIN (Mahomed). **A presumptive Culicine Host of the Human Malaria Parasites.**—*Trans. R. Soc. trop. Med. Hyg.* **31** no. 1 pp. 111–114, 14 refs. London, 25th June 1937.

It has been suggested that *Culex bitaeniorhynchus*, Giles, may transmit malaria since it breeds in pure water [*R.A.E.*, B **25** 70]. In

experiments in Malaya to test this point, 30 laboratory-bred females were allowed to feed once on persons heavily infected with gametocytes (2·3 to 10·3 per 100 leucocytes) of benign or malignant tertian malaria [*Plasmodium vivax* and *P. falciparum*], either separately or mixed, or of quartan [*P. malariae*] mixed with a less intense infection of malignant tertian. Cysts indistinguishable from those of malaria parasites were seen in 14, and of these 6 showed sporozoites in the salivary glands and 2 others sporozoites in the salivary glands and elsewhere. Of the 23 females that had fed on malignant tertian cases, cysts were found in 11, of which 6 showed sporozoites in the salivary glands. Black spores of Ross [*cf.* **21** 77] were found in 5, all of which had sporozoites in the salivary glands. In some of the 31 unengorged females examined as controls, bodies resembling sporozoites were observed, but all were on the hind-guts and none in or near cysts; these were probably due to infestation by other protozoa. With the exception of 5 brown pigment granules distributed between two cysts in separate mosquitos, no pigmented cysts and no black spores were seen in the controls.

Heavily pigmented brown and black cysts have been observed in male Anophelines bred in the laboratory (once in close association with sporozoite-like bodies present on the mid-gut surrounding the cysts). Thus, either pigmented cysts are not exclusively characteristic of the insect cycles of *Haemaproteus* and *Plasmodium*, or possibly larvae may become infected by some means from females dead upon the water after oviposition.

GEBERT (S.). **Notes on the Viability of** *Anopheles costalis* **Ova subjected to natural Desiccation.**—*Trans. R. Soc. trop. Med. Hyg.* **31** no. 1 pp. 115–117. London, 25th June 1937.

The experiments described were carried out in Mauritius to determine the period during which the eggs of *Anopheles gambiae*, Giles (*costalis*, auct.) could withstand desiccation. Since preliminary tests showed that they still hatched after two days, a further series was undertaken in which the conditions resembled as far as possible those obtaining in nature. Eggs were placed in concrete basins in the open where they would be exposed to the sun for about 5 hours daily. The water was siphoned off, and the eggs allowed to dry for various periods, after which water was again poured into the basins. It was found that 8 per cent. of the eggs hatched after 72 hours, but none after 96 hours. Most of the larvae obtained in the experiments developed normally to full-sized adults, and the mortality was not higher than in other breeding experiments. In Mauritius, most of the breeding places of *A. gambiae* are man-made and consist almost entirely of garden pools, the water from which is used for watering vegetables, so that kerosene cannot be applied as a larvicide. If in these cases drying is used as a control measure, the period should be 4 days.

SENIOR WHITE (R.). **The Presence of** *Anopheles sundaicus* ("*ludlowi*") **on the Chilka Lake.**—*Indian med. Gaz.* **72** no. 6 pp. 361–363, 6 refs. Calcutta, June 1937.

Outbreaks of malaria occurred on the Bengal-Nagpur Railway at stations (and in neighbouring villages) adjacent to the Chilka Lake in 1936 and 1937. The small numbers of Anophelines collected in

various localities included *Anopheles sundaicus*, Rdnw., but among those dissected the only ones found infected with malaria parasites were 2 out of 19 examples of *A. annularis*, Wulp, from one locality, one of which contained oöcysts and the other sporozoites. Larvae of *A. sundaicus* were not discovered and extensive surveys will have to be undertaken to determine whether they occur in the Lake. Previous investigations indicate that this species was not breeding there prior to 1932; the author considers that it arrived or at least bred in numbers for the first time in 1936. It does not yet appear to be universally distributed in the region.

TOKUNAGA (M.). **Sand Flies (Ceratopogonidae, Diptera) from Japan.**—*Tenthredo* **1** no. 3 pp. 233–338, 6 pls., 33 figs., 38 refs. Shinomiya, Yamashina, Kyoto, May 1937.

After reviewing the Japanese literature on Ceratopogonids and describing the larva, pupa and adults of both sexes of the genus *Culicoides*, the author gives detailed descriptions, with keys, of 31 species of blood-sucking midges from the Japanese Empire, 16 of which are new; they comprise one species of *Leptoconops* (*sens. lat.*), 4 of *Lasiohelea*, and 26 of *Culicoides*. In addition, comparative notes are given of a number of other species, chiefly from eastern Asia.

MAZZA (S.). **Investigaciones sobre la enfermedad de Chagas. IV.** *Crithidia gallardoi* **n. sp. Trypanosomidae de contenido intestinal de** *Microtomus lunifer* **(Berg) (Hemipt. Heteropt., Reduviidae).**—*Publ. Misión Estud. Pat. reg. argent. Jujuy* no. 32 pp. 37–43, 8 figs., 3 refs. Buenos Aires, 1937.

Numerous individuals of *Microtomus lunifer*, Berg, were found in birds' nests in the Chaco region of Argentina, either alone or associated with *Triatoma infestans*, Klug, and *Psammolestes coreodes*, Bergroth [*cf. R.A.E.*, B **25** 21]. The excreta of several adults of *Microtomus* contained flagellates here described as *Crithidia gallardoi*, sp. n. No infection occurred in mice following peritoneal and subcutaneous inoculation of the excreta.

PAPERS NOTICED BY TITLE ONLY.

YARWOOD (E. A.). **The Life Cycle of** *Adelina cryptocerci* **sp. nov., a Coccidian Parasite of the Roach** *Cryptocercus punctulatus*.—*Parasitology* **29** no. 3 pp. 370–390, 5 pls., 1 fig., 23 refs. Cambridge, 5th July 1937.

BISHOPP (F. C.) & SMITH (C. N.). **A new Species of** *Ixodes* [*muris* sp. n.] **from Massachusetts.**—*Proc. ent. Soc. Wash.* **39** no. 6 pp. 133–138, 1 pl., 1 fig. Washington, D.C., June 1937.

KING (W. V.) & BRADLEY (G. H.). **Notes on** *Culex erraticus* **and related Species in the United States** [synonymy with keys to males and larvae].—*Ann. ent. Soc. Amer.* **30** no. 2 pp. 345–357, 1 pl., 1 fig. Columbus, Ohio, June 1937.

KOMP (W. H. W.). *Anopheles acanthotorynus*, **a new Species of the Subgenus** *Stethomyia* **from Peru. (Diptera, Culicidae.)**—*Ann. ent. Soc. Amer.* **30** no. 2 pp. 358–360, 1 fig., 2 refs. Columbus, Ohio, June 1937.

de Leon (R.). *Anopheles* **Mosquitoes found at 10,500 Feet Elevation in Guatemala.**—*Publ. Hlth Rep.* **52** no. 29 p. 980. Washington, D.C., 16th July 1937.

Patton (W. S.). **Studies on the Higher Diptera of Medical and Veterinary Importance. A Revision of the Species of the Genus** *Musca*, **based on a comparative Study of the Male Terminalia. IV. A practical Guide to the Oriental Species** [contd].—*Ann. trop. Med. Parasit.* **31** no. 2 pp. 195–213, 10 figs., 10 refs. Liverpool, 13th July 1937. [*Cf. R.A.E.*, B **25** 192.]

Patton (W. S.) & Wainwright (C. J.). **The British Species of the Sub-family** Sarcophaginae, **with Illustrations of the Male and Female Terminalia.** [Part V.]—*Ann. trop. Med. Parasit.* **31** no. 2 pp. 303–317, 6 figs. Liverpool, 13th July 1937. [*Cf. R.A.E.*, B **25** 72.]

[Sokolov (N. P.) & Tarvit (I. A.).] **Соколов (Н. П.) и Тарвит (И. А.). Cold Resistance of** *Phlebotomus*. [*In Russian.*]—*Bull. Uzbek. Inst. exp. Med.* 1934 no. 1 pp. 27–32, 13 refs. Tashkent, 1935. (With a Summary in English, p. 57.) [Recd. 1937.] [*Cf. R.A.E.*, B **24** 158.]

Thompson (G. B.). **Siphonaptera recorded from the Pacific Islands.**—*Ent. mon. Mag.* **73** no. 879 pp. 185–187, 11 refs. London, August 1937.

Jordan (K.). **On some North American Siphonaptera** [including 2 new genera, 5 new species and a new subspecies.]—*Novit. zool.* **40** no. 2 pp. 262–271, 13 figs. Tring, 10th September 1937.

Jordan (K.). **A further Collection of Siphonaptera obtained by Mr. F. Shaw Mayer in eastern New Guinea** [including a new genus and 4 new species].—*Novit. zool.* **40** no. 2 pp. 272–282, 13 figs. Tring, 10th September 1937.

Jordan (K.). **Records and Descriptions of Siphonaptera** [including 4 new species].—*Novit. zool.* **40** no. 2 pp. 283–291, 10 figs. Tring, 10th September 1937.

Jordan (K.). **Some Siphonaptera from Morocco** [including a new species].—*Novit. zool.* **40** no. 2 pp. 292–294, 2 figs. Tring, 10th September 1937.

Jordan (K.). **A new Flea from China.**—*Novit. zool.* **40** no. 2 pp. 295–296, 2 figs. Tring, 10th September 1937.

Jordan (K.). **A new** *Xenopsylla* [*syngenis*] **from Nyasaland (Siphonaptera).**—*Novit. zool.* **40** no. 2 pp. 297–298, 3 figs. Tring, 10th September 1937.

Jordan (K.). **Two new Fleas from South America (Siphonaptera).**—*Novit. zool.* **40** no. 2 pp. 307–310, 5 figs. Tring, 10th September 1937.

Jordan (K.). **On some Australian Siphonaptera** [including a new genus and a new species].—*Novit. zool.* **40** no. 2 pp. 311–315, 3 figs. Tring, 10th September 1937.

JORDAN (J.). **Mosquito Larvicidal Measures.**—*Chin. med. J.* **51** no. 6 pp. 927–936, 4 refs. Peiping, June 1937.

The author gives a somewhat popular account of the more important mosquito breeding places in Shanghai, and discusses in a general way the larvicides that have been used in experiments. The most satisfactory of these appears to be that recommended by Ginsburg [*cf. R.A.E.*, B **23** 151], but other mixtures are being tested. The value of larvivorous fish appears to be limited; in Shanghai, *Gambusia* requires to be fed during the winter months if the necessity for re-stocking the ponds is to be avoided.

FENG (Lan-chou). **The Anopheline Mosquitoes and the Epidemiology of Malaria in China.**—*Chin. med. J.* **51** no. 6 pp. 1005–1020, 1 map, 12 refs. Peiping, June 1937.

Much of the information contained in this summary of the present state of knowledge on the Anopheline mosquitos and on the epidemiology of malaria in China has already been noticed [*R.A.E.*, B **24** 293; **25** 99, 233]. The first part contains a list of the 24 species and 6 varieties of Anophelines definitely recorded in China, lists of the species recorded in each of the 20 provinces in which surveys have been made, and lists of the species and probable malaria vectors in eight regions, *viz.*, northern Manchuria and Mongolia north of 45°N. lat., the plains and the hilly regions of north China and of central China, south China, the high plateau of Yunnan, and the north-west plateau. Details of the records of infection in Anophelines in China and of the results of important malaria surveys are shown in tables. The second part deals with the types of malaria infection and their distribution, and with the epidemiology of the disease, which is apparently governed in China by the suitability of conditions for the breeding of the vectors, by the introduction in bulk of non-immune populations, and by unusual heavy rains. On the whole, malaria is a more important problem in central and southern China than in the north.

ELSBACH (E. M.). *A. barbirostris bancrofti* **als overbrenger van** *Filaria bancrofti*. [*Anopheles bancrofti* as a Vector of *F. bancrofti*.]—*Geneesk. Tijdschr. Ned.-Ind.* **77** no. 25 pp. 1536–1543. Batavia, 22nd June 1937.

When dissecting malaria vectors at Tanah Merah on the Upper Digoel, New Guinea, the author found larvae of *Filaria bancrofti* in *Anopheles punctulatus* var. *moluccensis*, Sw., and in *A. bancrofti*, Giles. Backhouse has recorded artificial infection of *A. punctulatus* var. *moluccensis* and of the typical *A. punctulatus*, Dön [*R.A.E.*, B **22** 65] and de Rook regards *A. bancrofti* as suspect [**21** 146]. In the author's investigations, of 655 females of *A. bancrofti* taken in September and October, 72 (10·9 per cent.) were infected. Eight series of artificial infection experiments were made by exposing infected persons to batches of *A. bancrofti* captured in houses free from filariasis. Of a total of 285 mosquitos, 45 engorged and 22 became infected. In

both naturally and artificially infected mosquitos, the development of the filarial larvae was followed and their emergence from the proboscis was observed. They were able to complete development in 6–8 days.

URBINO (C. M.). **The Density of *Anopheles minimus* var. *flavirostris*, Ludl. by Trapping with Human Baits and its Relation with the Factors that influenced its Variations.**—*Mon. Bull. Bur. Hlth. Philipp.* **16** (1936) no. 12 pp. 471–481, 1 fldg. diagr., 24 refs. Manila, 1937.

Data on the prevalence of *Anopheles minimus* var. *flavirostris*, Ludl., were obtained from three traps with human baits that were in use at the malaria Field Laboratory at Tungkong Manga, Bulacan, from September 1929 to August 1935, except in November and December 1934. Records are given of the relative humidity, mean temperature and rainfall during the same period. The term "density" is used for the average number of mosquitos taken per catching night during a calendar month. The density for the whole period varied from 0 to 8·28 with a mean of 1·036. The annual rise in density usually begins in November or December when the rainy season is almost over and the rainfall is not sufficient to flush the streams, and the mean temperature and mean relative humidity are decreasing. The numbers are usually highest in January–March and fall abruptly in February–April when the mean relative humidity reaches, or is about to reach, its lowest point and the mean temperature is rising. The rainy season begins shortly after, and the density is lowest during this period.

From September 1929 to August 1932 (pre-agricultural period), only about 1–3 per cent. of the total area within about 2½ miles of the laboratory traps was under cultivation. The density varied from 0 to 4·57, with an average of 0·983. It was above the mean for the whole period during November 1929, January–June 1930, January–February 1931 and January–April 1932. From September 1932 to April 1934 (agricultural period), 40–50 per cent. of the land within the same area was cultivated. The density varied from 0 to 2·64 with an average of 0·429; only twice was it higher than the general average, when it reached 1·08 in January 1933 and 2·64 in January 1934. During the dry months, the vegetation was burned and the land was ploughed and harrowed, so that the hills were practically bare; the destruction of the daytime resting places of the adults in this way and by the trampling of domestic animals along the banks of streams may have accounted for the low density. The monthly number of clinic cases of malaria varied from 0 to 9, with an average of 1·7. After the harvest in October 1934, the farms were neglected and lay fallow. During this post-agricultural period, which lasted until the end of the experiment (August 1935), only about 1–3 per cent. of the land was cultivated and the streams were again covered with vegetation. The density varied from 0 to 8·28, with an average of 2·684, and remained most of the time above the general average. The abundance of adults in January and February 1935 and the presence of numerous human malaria carriers produced an epidemic in which the clinic cases reached 42 in March and 60 in April. The density did not fall below the general average until July 1935, when

the malaria epidemic subsided, owing probably to the anti-malaria campaign and the effects of continuous heavy rains. The differences between the means for the three periods are considered significant, and it is concluded that cultivation is an effective measure against malaria.

GASCHEN (H.) & RAYNAL (J.). **Recherches sur les affinités trophiques des Anophèles d'Indochine. Deuxième note.** *Anopheles vagus, A. minimus, A. jeyporiensis* et *A. aconitus.—Ann. Inst. Pasteur* **59** no. 1 pp. 57–93, 4 diagrs., 4 graphs, 16 refs. Paris, July 1937.

This note consists of three further parts of a work on the food-preferences of Anophelines in Indo-China [*cf. R.A.E.*, B **25** 4]; all the mosquitos studied were taken in Tonkin. In 1,028 females of *Anopheles vagus*, Dön., the maxillary index varied from 12 to 18, the average being 14·1, a figure similar to that obtained in 1932 [**21** 140]. The values lower than 14 were almost all obtained from examples from the coastal region, a fact suggesting the existence of races adapted to brackish waters. Precipitin tests with the same mosquitos revealed no examples containing human blood, although 750 of them had been taken in dwellings. Buffalo and cattle were the preferred hosts, and the former appeared to be more readily attacked than the latter.

The maxillary indices of 494 females of *A. minimus*, Theo., and of 501 of *A. jeyporiensis*, James, varied from 9·5 to 14·5 and 15, respectively; 98·8 and 96·6 per cent. had indices of less than 14, the averages being 11·6 and 12, figures that differ little from those already obtained [**21** 140]. Precipitin tests showed that 59·6 per cent. of the examples of *A. minimus* and 51·2 per cent. of those of *A. jeyporiensis* had fed on man. Of those taken in dwellings, 66 and 70 per cent. had fed on man, but although the two species appear to be almost equally anthropophilous, examination of those taken in stables showed that *A. jeyporiensis* is more attracted to cattle and buffalo (which are the hosts preferred by both after man) than *A. minimus*; both species appeared to prefer cattle to buffalo.

In 501 females of *A. aconitus*, Dön., the maxillary index varied from 9 to 15, more than 90 per cent. having an index of less than 14 and the average being 11·2 [*cf.* **21** 140]. From data taken largely from previous studies it appears that the maxillary indices of this species from a number of localities varies only slightly (10·9–11·5), giving no indication of the existence of biological races in Tonkin. On the other hand, the high index of some individuals in certain agricultural localities indicates a morphological instability. Since some precipitin tests gave mixed reactions, 605 tests were made with the 501 mosquitos; of these 14 were positive for human blood, 570 for animal blood and 21 were negative. The results are, however, invalidated by the fact that 422 of the mosquitos studied were collected where there were large numbers of domestic animals in sheds and all species of Anophelines were more or less attracted to them. When, however, the food preference of this group of females was compared with that of those from the localities where the human element predominated, the percentages containing human blood were 0·5 and 11·2, respectively. It is suggested that the food-preferences of this mosquito are unstable.

BURKE (M. R.). **Antimalaria Report upon the proposed Cantonment Site at Kau Lung Tsai.**—*J. R. Army med. Cps* **69** nos. 1–2 pp. 1–15, 84–100, 1 fldg map. London, July–August 1937.

A detailed account is given of the results of a mosquito survey of the site proposed for a new cantonment at Kau Lung Tsai on the mainland of Hong Kong, and of the area within half a mile (or in some places rather more) of its boundaries. The author discusses the topography of the locality, the mosquitos taken, the Chinese population of the area and its relation to the malaria situation, factors influencing Anopheline breeding (gradient of hill streams, cultivation, season, and fish), the resting and feeding habits of the adult mosquitos, factors affecting range of flight and dispersion, and measures that he considers should render the site reasonably free from malaria.

Between 26th March 1935 and 30th June 1936, 77,411 Anopheline larvae were collected and identified microscopically, and 3,536 Anopheline adults were reared from larvae and pupae. They comprised the following species: *Anopheles aitkeni* var. *bengalensis*, Puri, *A. hyrcanus* var. *sinensis*, Wied., *A. tessellatus*, Theo., *A. fluviatilis*, James, *A. minimus*, Theo., *A. jeyporiensis* var. *candidiensis*, Koidz., *A. maculatus*, Theo., *A. karwari*, James, and *A. splendidus*, Koidz. Between May 1935 and June 1936, 580 adults were collected, mainly from points selected in or near the part of the area on which building is most likely to take place; of these, 444 were dissected, but no malaria parasites were found. The species were the same as those taken as larvae, with the exception of *A. aitkeni* var. *bengalensis* and the addition of *A. vagus*, Dön. The Anophelines found infected in the Colony are briefly discussed [*cf.* *R.A.E.*, B **23** 34, 248; **25** 97]; *A. minimus* and *A. jeyporiensis* var. *candidiensis* are the most important vectors of malaria there [*cf.* **23** 80], and these two species were the ones most commonly taken in houses during the survey. Larvae of the former were collected chiefly from pools in the flat parts of boulder-strewn hill streams nearest to the foot-hills, and those of the latter in places where water was flowing slowly through grass, especially flooded abandoned rice-fields and swamps.

HU (S. M. K.). **Notes on the Filarial Infection of *Culex pipiens* var. *pallens* Coq. in relation to the Microfilarial Density of the Blood.**—*Lingnan Sci. J.* **16** no. 3 pp. 409–414, 3 refs. Canton, July 1937.

The following is taken from the author's summary of experiments in Shanghai. Two lots of *Culex pipiens* var. *pallens*, Coq., reared from the same batch of larvae were allowed to engorge separately at the same time on two cases of filariasis, one heavily and the other lightly infested with *Filaria* (*Wuchereria*) *bancrofti*, in order to ascertain the influence of the density of the microfilariae on the infection in the mosquito. The experiment was repeated on two subsequent evenings, using different batches of mosquitos, and on each occasion counts were made of the microfilariae in the blood. Of 89 mosquitos fed on the first case, 85·5 per cent. were infected, 55·2 per cent. harbouring 5 or more larvae each. Of 71 fed on the second, 40·8 per cent. were infected, 39·4 per cent. harbouring less than 5 larvae each. The average number of larvae was 12·1 among the positive mosquitos that had fed on the heavily infested case and 2·4 among those that had fed on the lightly infested one.

CHANG (Teh-ling). **Maxillary Teeth of *Anopheles hyrcanus* var. *sinensis* Wiedemann in relation to Blood Preferences.**—*Lingnan Sci. J.* **16** no. 3 pp. 435–438, 9 refs. Canton, July 1937.

The maxillary indices of females of *Anopheles hyrcanus* var. *sinensis*, Wied., that had been collected in bedrooms in the Kaochiao district of Shanghai and had subsequently fed on cow, goat, pig, man, dog, cat and fowl [*cf. R.A.E.*, B **25** 234] were, respectively, 17·1, 16·6, 17·2, 16·6, 17·5, 17·4 and 16·9 among the first batch and 17·1, 16·7, 17·5, 16·9, 17·1, 17·5 and 17·2 among the second. The average indices for the totals of the two batches were 17·0 and 17·1 as compared with that of 17·7 [**25** 139] for females caught in a cow-shed [**24** 191]. Thus, there appears to be little correlation between the food preferences and maxillary indices of mosquitos caught in bedrooms.

DE JESUS (P. I.). **Physicochemical Factors in Anopheline Ecology II : Studies on Turbidity, Chloride and Iron.**—*Philipp. J. Sci.* **62** no. 2 pp. 125–136, 4 refs. Manila, February 1937.

This is the second part of a paper on the physical and chemical factors affecting the breeding of *Anopheles minimus* var. *flavirostris*, Ludl., in the Philippines [*cf. R.A.E.*, B **25** 71]. The results of analyses of about 170 samples of water from the same breeding places as before for turbidity, and chloride and total iron contents are given in tables showing the frequency of occurrence of the same species of Anophelines in relation to these factors and also their seasonal variations.

Larvae of these mosquitos were usually found in clear water with turbidities ranging from 0 to 20 parts per million. They were also found, however, in the same breeding places when the turbidity was temporarily increased to 400 p.p.m. or more by the occasional wading of man or animals along the stream, or by heavy rains. They preferred concentrations of chloride ranging from mere traces to 7 p.p.m. (none was taken in waters having more than 11 p.p.m.), and a total iron content of less than 0·8 p.p.m., although they were temporarily found in waters with much higher concentrations of iron during the rainy season. Marked variations in the composition of the water occurred during certain months, especially at times of rain and flood, but in general, these Anophelines were found to breed in clear waters with small amounts of chloride and iron.

NICHOLAS (W. A.). **Notes on Antimalarial Measures in Java.**—*J. Malaya Br. Brit. med. Ass.* **1** no. 1 pp. 38–55, 8 pls., 4 refs. Singapore, June 1937.

This account of malaria and its control in Java was written as a result of a study tour carried out in connection with one of the international malariology courses of the League of Nations. Brief notes are given on the general administration of the Island, the organisation of public health work, the population, physical features and climate. The Anophelines recorded from the Netherlands East Indies comprise 46 species ; a list is given of the 13 principal ones and of the 10 that have been found infected in the course of malaria epidemics. The three species against which control measures are constantly applied in Java are *Anopheles sundaicus*, Rdnw., in the low coastal plains, and *A. aconitus*, Dön., and *A. maculatus*, Theo., in the highlands.

Malaria is endemic in many places; it is hyperendemic in the low coastal plains and in many parts of the interior. Fish-rearing is of great economic importance, and it is estimated that at least 125,000 acres are used for this purpose. There are innumerable fish-ponds along the coast and they are also found in the hilly districts. The relation between these fish-ponds and the high incidence of malaria was pointed out many years ago. In the salt-water ponds, in which *Chanos chanos* is reared, the salinity was reduced by rain-water and the seepage of ground water to a point that favoured the breeding of *A. sundaicus*, which has been found in concentrations as low as 1–2 parts salt per mille but is not abundant in those of more than 27 parts per mille. The most intense breeding occurred in ponds in which "floating algae" (chiefly *Enteromorpha*, *Chaetomorpha*, *Spirogyra*, etc.) sheltered the larvae from the attacks of *Haplochilus panchax* and other natural enemies. To control it, a method of periodic draining has been devised, in which the fish are preserved in a ditch round the edge of the pond and the stranded green algae are killed by desiccation [*cf.* *R.A.E.*, B **18** 185; **19** 170]. In one locality, cited as an example of the effectiveness of this method, the spleen rate has been reduced since 1928 from 100 to 25 per cent., and many of the children under 2 years of age have no palpable spleens. In a village 5 miles distant, where no control is attempted, all children and adults have enlarged spleens; the ponds that surround the village are covered with algae, and enormous numbers of larvae of *A. sundaicus* and *A. subpictus*, Grassi, breed in them. At Sourabaya, breeding in the basin constructed to take the surface drainage from a large part of the city was prevented by introducing salt water until conditions became unfavourable for the breeding of *A. sundaicus*; the spleen rate fell from 82 per cent. to 14 in 1929. In low-lying areas where silting takes place and the land becomes water-logged, various measures of filling and draining are carried out; in some cases stone drains are constructed out to sea, and in one place the swampy land is drained by a masonry canal that leads by a détour to a part of the coast where no silting occurs.

The fish-ponds in the interior contain fresh water and are used for rearing *Cyprinus carpio* and *Osphromenus olfax*. Before the institution of control measures, the edges were overgrown with grass, there were dense growths of submerged water plants, such as *Ceratophyllum*, *Hydrilla* and *Najas*, and on the surface floating weeds, such as *Spirogyra* and Characeae, which afforded excellent shelter for the larvae of *A. aconitus*, *A. barbirostris*, Wulp, and *A. hyrcanus*, Pall. The method of control finally evolved consists in stocking the ponds with three kinds of fish: *Cyprinus carpio*, which feeds on animal matter in the water and in the mud, *Helestoma temnecki*, which feeds on floating algae, and *Puntius javanicus*, which feeds when small (3–4½ inches long) on microscopic algae, diatoms, etc., and later (when more than 5½ inches long) on all types of algae, either floating or submerged, and on young grass shoots. Vegetation disappears from the ponds 3–4 weeks after the introduction of *P. javanicus*, which is full-grown in 3 months and is then edible. The edges of the ponds are closely trimmed or weeded.

An account is given of the increase in malaria in the Tjihea plain, where the vector is *A. aconitus* [*cf.* **20** 217] and of its subsequent diminution as a result of measures regulating the growing of rice [*cf.* **12** 48] and the distribution of irrigation water, which is entirely

cut off after 31st May. The spleen index declined from 100 per cent. in 1919 to 21·9 per cent. in 1921 ; in 1930 it was 20 per cent. By 1936, the soil had so improved that the value of the land had increased by 200 per cent. and the yield of rice by 33 per cent. In the contiguous Tjiandoer plain, the spleen rate is also high, but controlled irrigation has so far been impossible, owing to the difficulty of distributing water and to the fact that the inhabitants rear fish in the rice-fields after harvest. The vector is again *A. aconitus*, which breeds in irrigation canals, among rice stubble, in neglected fish-ponds, among young rice shoots less than 3 months old, and where the bunds and edges of the fields have not been cleared of vegetation. The measure recommended is the removal of all stalks and vegetation after the rice harvest and the maintenance of the water at a depth of at least a foot ; under these conditions no breeding occurs and the fish thrive. To prevent breeding among young rice shoots, the water is drained off periodically (about once a week).

Malaria in the hill regions of Java is due to *A. maculatus*, and measures against this mosquito on the tea estate visited consisted chiefly in shading the actual and potential breeding places. Streams 3–5 ft. wide and small narrow ravines were planted with *Tithonia diversifolia*, a shrub that grows practically wild all over Java. The appearance of grass along the edges of streams is taken as a sign that the shading is not sufficiently dense. In the case of broad ravines, the tree used is *Ochroma lagopus balsa*, which grows to a height of 20–30 ft. *Cassia alata* is suitable for shading swampy ravines, but should not be allowed to grow higher than about 5 ft. since the leaves then become sparse. The last two are often used in association with the first.

WILLIAMSON (K. B.). **The Control of Rural Malaria by Natural Methods.**—Med. 8vo, 4+26 pp. Singapore, L.o.N. Eastern Bureau, 1935. **References and Notes supplementary to " The Control of Rural Malaria by Natural Methods."**—Med. 8vo, 89 pp., 3 pls. Singapore, L.o.N. Eastern Bureau, 1936. [Recd. September 1937.]

The first paper is a revised reprint of one already noticed [*R.A.E.*, B **23** 130]. The second is a critically annotated bibliography of papers dealing chiefly with physico-chemical factors influencing the breeding of mosquitos and with measures for the control of malaria vectors in rural areas, for use in conjunction with it.

RICE (J. B.) & BARBER (M. A.). **A Comparison of certain Species of *Anopheles* with Respect to the Transmission of Malaria.**—*Amer. J. Hyg.* **26** no. 1 pp. 162–174, 1 chart, 4 refs. Lancaster, Pa, July 1937.

This comparison of *Anopheles sacharovi*, Favr (*elutus*, Edw.), *A. maculipennis*, Mg. (the typical form and race *messeae*, Flni.) and *A. superpictus*, Grassi, in relation to their importance in the transmission of malaria is based on a number of observations made in Greek Macedonia [*cf. R.A.E.*, B **23** 296 ; **24** 35 ; **25** 34] and a few in Cyprus [*cf.* **24** 267], where *A. maculipennis* does not apparently occur.

The following is taken from the authors' summary : The breeding places, seasonal prevalence, density in human habitations, choice of hosts, susceptibility to malaria infection, longevity, sporozoite index,

and degeneration of sporozoites [*cf.* **24** 290], are considered in relation to malaria transmission. The value of these different criteria is discussed, and it is emphasised that no single one of them is adequate to indicate the degree of culpability of an Anopheline species. Malaria surveys of children of all ages, including infants, are a valuable aid in the study of mosquito vectors.

Certain experiments and observations indicate that *A. maculipennis* and *A. superpictus* are attracted to domestic animals as hosts independently of the climatic environment of the latter. *A. sacharovi* is comparatively indifferent in its choice of man or domestic animals as a source of blood meals. In *A. superpictus* mammalian blood clots less early and less completely than in the other two species, and its ability to produce a precipitin reaction disappears earlier.

New evidence is given that strengthens the conclusion of previous years that *A. superpictus* plays a minor part in the transmission of malaria in some parts of Macedonia, in spite of its abundance and its relatively high sporozoite index.

Ayroza Galvão (A.) & Lane (J.). **Notas sobre os** *Nyssorhynchus* **de São Paulo (Diptera, Culicidae).**—*Ann. Fac. Med. S. Paulo* **12** (1936) no. 2 pp. 269-288, 32 figs., 1 map, 30 refs. S. Paulo, 1937.

In studying the transmission of malaria in Brazil, it is desirable to ascertain whether there is any analogy between the parts played in Europe by the various races of *Anopheles maculipennis*, Mg., and in South America by the local vector species, which are numerous and many of which include varieties or present variable characters. It is, for instance, difficult in the *tarsimaculatus* series to distinguish the adults of *Anopheles strodei*, Root, from those of *A. tarsimaculatus*, Goeldi. About 80 per cent. of the individuals of *A. albitarsis*, Arrib., can be identified with the usual keys, but about 10 per cent. at either extreme show variation.

The species of the *Nyssorhynchus* group have been studied only recently in South America, *A. bachmanni*, Petrocchi (in Argentina) and *A. strodei* having been described in 1925 and 1926, respectively. A further difficulty results from differences in their biology, which varies with geographical distribution, an efficient vector in one region being harmless in another. If there be an analogy with the position in Europe, each South American species would have various races, differing in biology and distribution. Possibly, however, each group of species occupies a position corresponding to that of *A. maculipennis*, the species in it representing the varieties of the latter. The verification of this hypothesis requires a comparative study of the species in their entire life-cycle. Early in the present investigations on the *Nyssorhynchus* group in São Paulo, it was noticed that the geographical limits of the tertiary strata (in the Paraíba valley and round the metropolis) coincided exactly with those of the zone of occurrence of Anophelines in the absence of malaria, geological differences apparently influencing the biology of the local Anophelines by modifying the physico-chemical factors that affect the larvae.

Larvae collected in July after a cold day with a temperature of 0·4°C. [32·72°F.] from breeding places with more or less turbid water included some newly hatched individuals, but no eggs were obtained. With the advent of warmer weather and more frequent rains, eggs

were collected in fair numbers. It is therefore suggested that in the dry, cold season, evaporation of the water leaves the eggs stranded on the edges of the pool or on plants, but that they hatch when refloated later. Of adults reared from fourth-instar larvae in July and August 93·5 per cent. were *A. strodei* and 6·5 per cent. *A. albitarsis*, but in November the numbers of the two species were almost equal. In laboratory observations, 2 females of *A. strodei* fed 5 and 7 times, respectively, before oviposition, and one female of *A. albitarsis* fed 4 times. One of the former laid 138 eggs in 48 hours and then died. The oviposition of the female of *A. albitarsis* was purposely interrupted after 19 eggs had been laid ; it laid further batches of 195 and 57 eggs after intervals of 10 and 9 days, respectively, having lived for a total of 25 days and taken 12 meals. Females in captivity were able to feed many times before pairing ; one took 13 meals in 10 days and 3 more after fertilisation and oviposition. First-instar larvae of *A. strodei* were much influenced by environment, growing very slowly in water that had become acid through fermentation of bread, etc., placed in it as food. Restoration of alkalinity by adding a carbonate solution accelerated their development and increased their vitality. Descriptions are appended of the eggs, four larval instars, and adults of *A. strodei* and *A. albitarsis*. Attention is drawn to two atypical adults, here attributed to *A. albitarsis* [but subsequently found to belong to a species described by the authors as *A. pessôai* (*R.A.E.*, B **25** 214)].

Herms (W. B.). **The Clear Lake Gnat.**—*Bull. Calif. agric. Exp. Sta.* no. 607, 22 pp., 10 figs., 2 refs. Berkeley, Calif., June 1937.

A detailed account is given of observations made at different times over a number of years on the bionomics and control [*cf. R.A.E.*, B **19** 95 ; A **23** 36] of *Chaoborus lacustris*, Freeborn, in California.

[**Mosquito Control Work in 1936.**]—*Proc. N.J. Mosq. Ext. Ass.* **24** 236+3 pp., 8 pls., 19 figs., many refs. New Brunswick, N.J., 1937.

In addition to reports on local mosquito situations and control work in Connecticut, New York City, Delaware, Pennsylvania, and California, and on equipment for use in drainage work, the following papers are included : Principles underlying the Protection of Outdoor Meetings from the Mosquito Pest and Methods of Application [*cf. R.A.E.*, B **24** 34], by J. M. Ginsburg (pp. 5–11), Methods of applying the Larvicide as a Repellent, by R. L. Vannote (pp. 11–13), and Experiments in Florida in repelling Mosquitoes by outdoor Spraying, by W. V. King, G. H. Bradley & T. E. McNeel (pp. 163–172) ; Maintenance of a Supply of Mosquitoes for experimental Work during the Dormant Season, by P. Granett & G. E. Powers (pp. 15–20) ; A Summary of Mosquito Work in New Jersey in 1936, by T. D. Mulhern (pp. 34–66) ; A Résumé of Work on Mosquitoes throughout the World in 1936, by F. C. Bishopp & C. N. Smith (pp. 69–96) ; Mosquito Suppression Work in Canada in 1936, by A. Gibson (pp. 96–108) ; The Effect of Summer Rainfall on Mosquito Prevalence, by R. J. van Derwerker (pp. 152–163) ; Mosquito Migration across Delaware Bay, by D. MacCreary & L. A. Stearns (pp. 188–197) ; Outletting inclosed Marshes to the Sea, by W. Austin & O. W. Lafferty (pp. 223–225) ; Effect of Mosquito Reduction Work on Malaria

Prevalence in Pennsauken Township and Camden County Areas [*cf.* **25** 186], by F. C. Metzger (pp. 225–227), which records chiefly the drainage measures carried out and the fact that only 2 new cases of malaria occurred in 1936 in an area in which 92 had occurred in 1935; and Mosquito Problems, by T. J. Headlee (pp. 228–236).

In New and Significant Experiences in Mosquito Control in the DesPlaines Valley Mosquito Abatement District (pp. 112–126), J. L. Clarke describes experiments on the flight range of *Aëdes vexans*, Mg., in which the mosquitos were stained by dusting areas of swamp where they were abundant in the marsh grass with concentrated dye in powder form. The cost was estimated at about 1½d. per thousand. In the experiments 31,000,000 mosquitos were stained, 92,000 were caught within 20 miles, and 381 stained examples were recovered. In order that the stain should not be applied too heavily and that it should be well distributed, the dye was diluted with flour at the rate of 1 part to 9. The dust was applied as soon as the marsh grasses harboured 25–100 newly emerged mosquitos per square foot; the females of this species remain on the marsh for 24–48 hours prior to flight. The dust was directed into the foliage just above the water, and sample catches showed that 85 per cent. of the mosquitos had been stained.

[MISHNAEVSKIĬ (M. N.).] **Мишнаевский (М. Н.).** Ed. **The Malaria Mosquito and Measures of Control.** [*In Russian.*]—Demy 8vo, 224 pp., 4 pls., 56 figs., 93 refs. Rostov-on-Don, Azovo-Chernom. kraev. Knigoizd., 1937. Price 6 *rub.* 50 *kop.*

This handbook is intended for the use of the health officers of local anti-malaria organisations in the Russian Union and consists of four parts. In the first, by I. G. Ioff (pp. 5–116), the characters distinguishing Anophelines from other blood-sucking mosquitos are shown in a table, and keys are given to the adults and larvae of the chief genera of mosquitos, the key to larvae also including genera of Chironomids and Ceratopogonids that might be confused with mosquito larvae. Keys are also given to the adults and larvae of the 7 species of *Anopheles* that occur in the Russian Union, of which *A. maculipennis*, Mg., *A. claviger*, Mg. (*bifurcatus*, auct.), *A. plumbeus*, Steph., and *A. hyrcanus*, Pall., are widely distributed, whereas *A. superpictus*, Grassi, *A. pulcherrimus*, Theo., and *A. algeriensis*, Theo., have only been recorded from Central Asia and the Caucasus. The bionomics and races of *A. maculipennis* are briefly discussed. Separate chapters deal with the part played by Anophelines in the transmission of malaria and with measures of control. The latter include destruction of aquatic vegetation, artificial pollution of accumulations of water to make them unfit for Anopheline larvae, oiling, dusting with Paris green by means of hand apparatus and from aeroplanes, the use of *Gambusia* and other larvicidal fish, the destruction of adult mosquitos in dwellings, cattle sheds and hibernation quarters, screening of houses, and the use of mosquito nets.

The second part, also by I. G. Ioff (pp. 117–153), contains an account of the types of breeding places of *A. maculipennis*, and the work that should be carried out to eliminate them, either by drainage or the improvement of neglected ditches, ponds, etc.

In the third part (pp. 154–203), A. A. Dotzenko discusses the work that should be carried out in the Azov–Black-Sea Province for the

elimination of the breeding-places of mosquito larvae by reclamation of swamps, and the improvement of rivers, water reservoirs, and irrigation systems.

In the fourth part (pp. 204–219), V. A. Nabokov outlines the history of the use of aeroplanes to apply dust insecticides against Anopheline larvae in the Russian Union since 1929, and the organisation and technique of the work.

[BEKLEMISHEV (V. N.).] **Беклемишев (В. Н.). Sur la phénologie des anophèles.** [*In Russian.*]—*Med. Parasit.* **6** no. 1 pp. 3–12, 2 graphs, 13 refs. Moscow, 1937. (With a Summary in French.)

In connection with a programme of observations on Anophelines in the Russian Union [*R.A.E.*, B **23** 289], the author discusses the importance of studying the seasonal fluctuations in their abundance in a given locality, and the way in which the data obtained can be used to ascertain the effect of control measures [*cf.* **24** 262]. A study of records of the seasonal occurrence of Anophelines in the temperate zone of the northern hemisphere indicates that most of them have a seasonal curve with only one peak, which occurs in autumn, as the population augments during the summer and decreases in winter, this being the case with *Anopheles maculipennis*, Mg., in central and eastern Europe, *A. hyrcanus*, Pall., in Uzbekistan, and *A. superpictus* Grassi, in western Turkmenistan. Mosquitos in the southern part of their area of distribution, however, such as *A. maculipennis* in Palestine, Spain or California, and *A. claviger*, Mg. (*bifurcatus*, auct.) in Turkmenistan, are unfavourably affected by the heat of summer, and their seasonal curves show two peaks, in the spring and autumn. On the other hand, in the northern part of their range, mosquitos of southern origin, such as *A. superpictus* in many parts of Europe and in Uzbekistan, *A. pulcherrimus*, Theo., in Uzbekistan, *A. hyrcanus* in the Ukraine and the Russian Far East, and *A. hispaniola*, Theo., in Spain, show a delay in the beginning of the seasonal increase of the population because the temperature in spring and early summer is relatively low. It appears that the northern limits of the distribution of *A. superpictus*, *A. pulcherrimus* and *A. hyrcanus* depend on the temperature at this time, and not on that in winter.

[SHLENOVA (M. F.) & IVANOVA (A. F.).] **Шленова (М. Ф.) и Иванова (А. Ф.). Analyse de l'âge d'une population d'** *Anopheles maculipennis* **en rapport avec les mesures anti-anophéliennes.** [*In Russian.*]—*Med. Parasit.* **6** no. 1 pp. 13–19, 1 graph, 5 refs. Moscow, 1937. (With a Summary in French.)

In the course of an anti-malaria campaign carried out in 1935 in a sedge peat district in the Department of Moscow, an attempt was made to determine the physiological age of the females of *Anopheles maculipennis*, Mg., that occurred in resting places [*cf. R.A.E.*, B **24** 70], with a view to ascertaining whether a periodical increase in their numbers was due to immigration or to the emergence of young adults from the breeding places, which were dusted from an aeroplane at intervals between 5th June and 8th September. Details of the seasonal occurrence of the successive generations are given. Adults were collected daily in cow-sheds and in traps placed in tents and huts, and 30,000 mosquitos were thus taken between

8th May and mid-September. Of these, 3,150 were dissected and the physiological age of 531 was determined by measuring the oviduct [**21** 71]. No mosquitos infected with malaria were found. After each successful dusting of the breeding places, there were fewer newly emerged adults, whereas each failure was followed by an increase in the mosquito population in the shelters and by a reduction in the mean size of the oviducts, this being due to the presence of newly emerged females that had not oviposited. Mosquitos with the maximum mean size of the oviducts occurred in the first half of June, when only overwintered females, most of which had laid eggs in the spring, were present in the shelters. From the beginning of August, the number of young females with undeveloped oviducts gradually increased, together with individuals having an abundant fat-body and immature eggs. The daily catches of mosquitos considerably lowered the mean age of the population, and decreased the numbers of females that had fed and oviposited many times and would thus be most likely to be vectors of malaria, a fact that confirms the value of destroying mosquitos in houses in summer [*cf.* **23** 276].

[RAKHMANOVA (P. I.).] **Рахманова (П. И.). Rôle des bactéries dans la vie des larves des Culicidae.** [*In Russian.*]—*Med. Parasit.* **6** no. 1 pp. 20–36, 1 fig., 5 graphs, 5 refs. Moscow, 1937. (With a Summary in French.)

A detailed account is given of laboratory experiments carried out in Moscow with a view to determining whether pure cultures of bacteria can provide sufficient food for mosquito larvae, and what are the interrelations between the bacteria and the larvae. Experiments in which larvae of *Anopheles maculipennis*, Mg., were kept in suspensions in water of *Bacillus fluorescens* gave negative results, as all the larvae gradually died off in the course of their development. On the other hand, suspensions of pure cultures of *B. coli* prepared with sterilised tap water proved to be suitable food for the larvae of both *A. maculipennis* and *Culex pipiens*, L., adults being obtained where the concentration of bacteria was high. This concentration had no detrimental chemical effect on the larvae, as, owing to the fact that the medium was not sufficiently nourishing, the bacteria did not increase to any appreciable extent. On the other hand, at low concentrations or in small receptacles, the bacteria present were rapidly devoured by the larvae and the latter died of hunger. Large quantities of bacteria are, therefore, necessary when they are the sole food of the larvae.

In experiments with *A. maculipennis* and actively growing mixed cultures of bacteria prepared with a hay infusion and free of any solid substratum, the larvae, when too numerous or when placed in a small receptacle, consumed all the bacteria and then died of starvation. On the other hand, if the concentration of the infusion was high and the container large, the bacteria increased rapidly, fermentation took place, and the larvae were killed by the film formed. Although the development of the young larvae was more rapid in the presence of a greater number of bacteria, mortality increased at the same time. Larvae that survived eventually consumed all the bacteria, after which their development was retarded and they died of starvation.

In a hay infusion with hard particles of the hay at the bottom of the receptacle, the larvae, if present in insufficient numbers, were killed

by the bacteria, which were excessively abundant. If, however, the larvae were numerous, a balance was established, as although they consumed all the bacteria, the latter were continuously replaced by new ones that developed in the substratum on the bottom of the container. An excessive abundance of the larvae resulted, however, in starvation and ultimate death. Since an increasingly larger amount of water is filtered by the larvae in 24 hours as they mature, the supply of bacteria can only be maintained on a favourable level if, all other conditions being equal, the number of larvae progressively decreases. Under experimental conditions, the equilibrium was only reached when the larvae checked the excessive increase of the bacteria ; in the field, however, the action of the larvae is to a great extent supplanted by that of other organisms that feed on bacteria or detritus, and by the presence of green plants.

The author suggests that various factors, such as the hydrogen-ion concentration of water, or the presence in it of nitrogen compounds or oxygen, that are believed to have a direct action on larvae of *A. maculipennis*, often affect them indirectly by their influence on bacterial processes.

[Ovchinnikov (K. M.), Tishchenko (O. D.) & Morozova (L. I.).] **Овчинников (К. М.), Тищенко (О. Д.) и Морозова (Л. И.). Observations on the Effect of different Rates of Flow in Canals and of small Waterfalls on Larvae of** *Anopheles maculipennis*. [*In Russian.*]—*Med. Parasit.* **6** no. 1 pp. 37–55, 5 figs. Moscow, 1937. (With a Summary in English.)

Observations to determine the minimum rate at which water in canals and ditches should flow to prevent the breeding in them of *Anopheles maculipennis*, Mg., were carried out in the Province of Kharkov in 1935. For this purpose, two irrigation ditches were cleared of field plants and weeds, and aquatic vegetation was planted in them and along the banks. Alternate sections, each 13 ft. long, were artificially infested with a counted number of larvae of *A. maculipennis* in various instars. The flow of the water was regulated by shields, and the effect on the larvae of currents of different rapidity was studied by taking samples after each experiment and calculating the percentage of the larvae present in relation to their initial number. The results, which are tabulated, showed that when the water was flowing at rates varying from 0·4 to 1 ft. per second, 84–100 per cent. of the larvae were dislodged, depending on their position and that of the vegetation ; of these, up to 90 per cent. remained along the banks, but some were carried to the end of the ditch. The larvae collected were kept under observation for 4–5 days ; they continued to develop normally and mortality among them exceeded that among control larvae by only 2–3 per cent. The authors conclude that the speed of 0·66 ft. per second recommended for malaria control as a standard for water flowing in canals is not sufficient for the destruction of Anopheline larvae. Moreover, it does not meet the requirement for preventing the growth of vegetation and the accumulation of silt in the canals, which is estimated at 0·8–1·3 ft. per second, depending on natural conditions ; this rate of flow should therefore be adhered to, since it will also prevent Anopheline breeding.

Flushing the ditch with a single wave, the initial speed of which was 0·66–1·8 ft. per second killed larvae of the first instar only, though the

older ones were carried to the zone along the banks. Flushing with two subsequent waves at intervals of 10 seconds or more carried about 76 per cent. of the larvae out of the experimental part of the ditch.

Laboratory experiments, the technique of which is described, were so arranged that larvae of *A. maculipennis* were carried over small waterfalls or were confined in the water beneath them. In the various tests, 17–40 per cent. of them were killed, but mortality in the first instar reached 60–64 per cent. The rate of mortality depended on the volume and force of the falling water, and it is possible that a system of artificial waterfalls may be of value in freeing canals from Anopheline larvae.

[SHUB (G. M.) & NIKOLAEV (B. P.).] **Шуб (Г. М.) и Николаев (Б. П.). The northern Limit of the Distribution of Malaria in the Leningrad District.** [*In Russian.*]—*Med. Parasit.* **6** no. 1 pp. 56–66, 11 refs. Moscow, 1937. (With a Summary in English.)

In continuation of investigations on malaria in Karelia [*R.A.E.*, B **24** 138], a survey was carried out in 1936 in the Murmansk Region (Kola Peninsula) and in the adjoining northern part of Karelia as well as in the southern part. No locally acquired malaria was found anywhere, but several hundred imported cases were observed. Of the mosquitos taken, species of *Theobaldia* and *Aëdes* were abundant in practically all the localities in which investigations were made, but *Anopheles maculipennis*, Mg., and *Culex pipiens*, L., were only present in Karelia, the former not occurring further north than 66°N. Lat. Observations in southern Karelia confirmed the conclusion that it has two generations a year [*loc. cit.*], and the temperature in northern Karelia and the Kola Peninsula would theoretically permit the development of one generation. Measures against it are not necessary in localities in which the mean July temperature is below 15–16°C. [59–60·8°F.], under which conditions the malaria parasite cannot develop in it.

[KESHISH'YAN (M. N.).] **Кешишьян (М. Н.). Anophèles du Pamir.** [*In Russian.*]—*Med. Parasit.* **6** no. 1 pp. 67–68. Moscow, 1937. (With a Summary in French.)

Investigations on Anophelines in the Pamir plateau in southern Tadzhikistan were carried out in the summer of 1936. The only species found were *Anopheles claviger*, Mg. (*bifurcatus*, auct.) and *A. superpictus*, Grassi, both of which occurred in the Rushansk district situated at an altitude of about 6,700 ft. Larvae of *A. claviger* were numerous in accumulations of water formed by mountain springs and densely covered with aquatic vegetation, and several males and one female were captured in the grass nearby. No adults were found elsewhere. No larvae of *A. superpictus* were found, but 8 adults were caught in August. Examination of the blood of 500 persons from three villages showed no malaria infection.

[SHCHURENKOVA (A. I.).] **Щуренкова (А. И.). Les phlébotomes du Pamir.** [*In Russian.*]—*Med. Parasit.* **6** no. 1 pp. 69–72. Moscow, 1937. (With a Summary in French.)

In July 1936, sandflies were collected in the western part of the Pamir plateau in villages at altitudes of 6,700–7,600 ft. They could

not be found at higher altitudes. Of 1,108 individuals taken, 506 were *Phlebotomus longiductus*, Parr., 451 *P. sergenti*, Parr., 76 *P. caucasicus*, Marz., and 75 *P. keshishiani*, Shchur. [*cf. R.A.E.*, B **25** 198]. The sandflies were particularly abundant in the town of Khorog and readily attacked man.

[Antonov (N. I.) & Naĭshtat (A. G.).] **Антонов (Н. И.) и Найштат (А. Г.). Fièvre exanthématique de l'extrême orient causée par les tiques.** [*In Russian.*]—*Med. Parasit.* **6** no. 1 pp. 73–81, 2 graphs. Moscow, 1937. (With a Summary in French.)

An account is given of observations carried out in 1936 near Vladivostok and a number of districts along the Ussuri and middle Amur rivers on a disease that was apparently a form of typhus transmitted by ticks or Trombidiid mites. The symptoms are described. As a rule, it occurred among agricultural workers in sparsely populated areas, which were covered with dense bush and weeds and harboured numerous rodents, and at times when various ticks were numerous in the bush and readily attacked man, the maximum number of cases being invariably observed in May. The vector or vectors have not yet been identified, but *Dermacentor silvarum*, Olen., though common in the region, is probably not one, since no infection was produced in guineapigs and rats after injection of suspensions of this tick. In one of the districts in which the disease occurred, a number of Trombidiid mites were collected.

[Latuishev (N. I.).] **Латышев (Н. И.). Notes épidémiologiques sur la fièvre papataci et les spirochètes au Tadjikistan.** [*In Russian.*]—*Med. Parasit.* **6** no. 1 pp. 82–90, 2 graphs, 16 refs. Moscow, 1937.

In the course of investigations on the epidemiology of sandfly fever in Stalinabad (western Tadzhikistan) in the summer of 1935, sandflies were collected on fly-papers placed in outhouses, inhabited dwellings, a cave on the bank of the river known as a breeding focus of *Ornithodorus papillipes*, Bir. [*R.A.E.*, B **19** 256], and other places. Of 6,600 taken between 7th July and 10th October, 51·5 per cent. were *Phlebotomus papatasii*, Scop., and 41·8 per cent. *P. minutus*, Rond., the other species, in descending order of abundance, being *P. alexandri*, Sinton, *P. caucasicus*, Marz., *P. chinensis*, Newst., and *P. sergenti*, Parr. About 40 per cent. of the females of *P. papatasii* taken in dwellings, where it was much the most abundant species, contained blood in different stages of digestion. From the middle of August, the numbers of females with developed ovaries began to increase, and in mid-September 50 per cent. of those of *P. papatasii* and *P. minutus* contained mature eggs, which suggests that oviposition begins then and hibernation may take place in the second and third larval instars. In inhabited houses, the maximum numbers of sandflies were taken in the second half of July and in the first ten days of September, which coincided with two peaks in the incidence of sandfly fever. The tick-infested cave proved to be a breeding focus, since, when the entrance was covered with a screen in which were two traps, 2·3 times as many sandflies were taken in the trap arranged to catch them on their way out as in the one arranged to catch them on their way in. All efforts to find sandfly larvae were unsuccessful.

In view of the fact that Whittingham has isolated spirochaetes from the blood of patients suffering from sandfly fever [**11** 60], and Couvy found spirochaetes in the blood of rabbits after injecting into them a suspension of sandflies, the author injected into rabbits separate suspensions prepared from males and females. Positive results with the males would have shown that the infection is hereditary in the sandfly. No organisms, however, were recovered from any of the inoculated animals, and they showed no rise in temperature during the 15 days of observation.

Attempts to discover *Leishmania* in smears and cultures of blood of 86 examples of the gecko, *Gymnodactylus caspius*, were unsuccessful.

Mus (*Rattus*) *turkestanicus* was abundant in the cave infested with *O. papillipes*, and relapsing fever spirochaetes were found in the blood of two examples of this rat. As it sometimes occurs in houses and can migrate for considerable distances, it may easily carry ticks to villages where they could transmit the disease to man.

[Beklemishev (V. N.) & Detinova (T. S.).] **Беклемишев (В. Н.) и Детинова (Т. С.).** *Anopheles maculipennis maculipennis* **au Kopet-Dag (RSS du Turkmenistan).** [*In Russian.*]—*Med. Parasit.* **6** no. 1 pp. 134–135. Moscow, 1937. (With a Summary in French.)

In the summer of 1936, *Anopheles maculipennis*, Mg., which had not previously been recorded from Russian Central Asia, was found in south-western Turkmenistan. Females were taken in day-time shelters, and all the eggs laid, a detailed description of which is given, had the characters of race *maculipennis* (*typicus*). Larvae were found in several localities, chiefly in irrigation ditches. In June and July, the adults were scarce, constituting less than 1 per cent. of the Anophelines taken in shelters, *A. superpictus*, Grassi, being the predominant species. A female of *A. sacharovi*, Favr (which the authors regard as a race of *A. maculipennis*) was caught at the end of July.

[Kolpakova (S. A.) & Ékstrem (N. V.).] **Колпакова (С. А.) и Экстрем (Н. В.). On Epizootology of Tularaemia. II. Terms of Conservation of Ectoparasites in the old Nests of Murids and the Longevity of** *Bacterium tularense* **in these Parasites.** [*In Russian.*] —*Rev. Microbiol.* **15** (1936) no. 3–4 pp. 351–356, 4 refs. Saratov, 1937. (With a Summary in English.)

Examinations of the nests of Murid rodents in the Stalingrad district, in connection with the epizootic of tularaemia among ground squirrels (*Citellus pygmaeus*) there [*cf. R.A.E.*, B **23** 85], were continued from mid-July 1934 to the end of October 1935. Of 2,629 fleas collected from 599 inhabited nests and 179 from 876 uninhabitated ones, *Ctenophthalmus orientalis*, Wagn., was the most numerous, being followed in abundance by *Ceratophyllus tesquorum*, Wagn. Other species found were *Ctenophthalmus pollex*, Wagn. & Ioff, *Ceratophyllus mokzreckyi*, Wagn., *C. consimilis*, Wagn., *Amphipsylla rossica*, Wagn., *Neopsylla setosa*, Wagn., and *Mesopsylla tuschkan*, Wagn. & Ioff. The field mouse, *Microtus arvalis*, and the water rat, *Arvicola amphibius*, were found to be the chief hosts of *Ctenophthalmus orientalis*, which increased in abundance as these rodents became more numerous in the autumn of 1935. *Citellus pygmaeus* was the

principal host of *Ceratophyllus tesquorum*, but this flea readily changed its hosts during the active period of the life of the ground squirrel, when it came in close contact with the Murids. The fact that only a few fleas occurred in old uninhabitated nests showed that, after the severe epizootic among the Murids in the autumn of 1933 [*loc. cit.*], the nests became free from fleas during the spring and summer of 1934.

Some 1,500 unidentified Gamasid mites were also collected, of which about 500 occurred in the uninhabited nests.

To determine whether tularaemia persists in the fleas, suspensions of 352 fleas from the nests, including *Ctenophthalmus orientalis*, *C. pollex* and *Ceratophyllus tesquorum*, were injected into guineapigs in 1935, but no infection resulted.

[Zasukhin (D. N.) & Tikhomirova (M. M.).] **Засухин (Д. Н.) и Тихомирова (М. М.). De la conservation des** *Pasteurella pestis* **dans les larves et les nymphes des tiques** *Dermacentor silvarum* **Olen.** [*In Russian.*]—*Rev. Microbiol.* **15** (1936) no. 3–4 pp. 357–362, 10 refs. Saratov, 1937. (With a Summary in French.)

In view of the fact that the hosts of larvae and nymphs of *Dermacentor silvarum*, Olen., include rodents that are often infected with plague, and the adults infest domestic animals, including camels, which are subject to the disease, and may transmit plague to them and man [*cf. R.A.E.*, B **20** 104; **21** 273], experiments were carried out in Saratov to determine how long *Bacillus* (*Pasteurella*) *pestis* can survive in the larvae and nymphs. For this purpose, larvae and nymphs were allowed to feed on infected guineapigs, and, after intervals varying from 1 to 14 days, they were crushed and suspensions prepared from them were injected into healthy guineapigs or mice. The results showed that the larvae sometimes contained virulent bacilli for as long as ten days, and the nymphs for as long as six. In no case could the presence of bacilli be demonstrated in ticks of either stage if they had moulted after the infecting feed. Over 60 per cent. of both nymphs and larvae died during the experiments, which indicates that *B. pestis* is pathogenic to them.

It is concluded that this tick cannot infect rodents with plague, as it only harbours the bacilli for a short time, loses them when it moults and usually feeds only once in each stage of development.

[Tiflov (V.) & Kolpakova (S.).] **Тифлов (В.) и Колпакова (С.). Die Flöhe des Fuchses** (*Vulpes vulpes* **L.**) **und drei neue Floharten aus der U.d.S.S.R.** [Fleas of the Fox and three new Species of Fleas from the Russian Union.] [*In Russian.*]—*Rev. Microbiol.* **15** (1936) no. 3–4 pp. 413–423, 8 figs., 12 refs. Saratov, 1937. (With a Summary in German.)

In view of the close contact between foxes and the rodents on which they feed, some of which are reservoirs of plague or tularaemia, a list is given of 14 species of fleas collected on foxes and in a fox burrow in different parts of the Russian Union during 1923-32. The collection comprised 760 fleas, of which over 60 per cent. were *Pulex irritans*, L., and about 23 per cent. *Ctenocephalides canis*, Curt. The others were *C. felis*, Bch., 6 species that usually attack rodents and 5 that are thought to be primarily fleas of foxes. These include *Chaetopsylla korobkovi*, sp. n., both sexes of which are described, from a fox in

south-western Kazakstan. Descriptions are also given of *Neopsylla meridiana*, sp. n., taken on *Microtus* sp. in the Kirghiz Republic (Central Asia), and of *Ctenopsylla sicistae*, sp. n., on *Sicista nordmanni* in western Kazakstan.

[ROSHKOVSKAYA (O. A.).] **Рошковская (О. А.). Zum Studium der Flöhe der Rattenbauten in der Stadt Woroschilovsk und in einigen anderen Rayons des Nord-Kaukasischen Gebietes.** [Contribution to the Study of the Fleas of Rats occurring in the Town of Voroshilovsk and in some other Districts of the Province of North Caucasus.] [*In Russian.*]—*Rev. Microbiol.* **15** (1936) no. 3–4 pp. 424-429. Saratov, 1937. (With a Summary in German.)

The relation to plague of the rat-fleas, *Ceratophyllus fasciatus*, Bosc, and *Xenopsylla cheopis*, Roths., is reviewed from the literature; in the Russian Union *X. cheopis*, which is the more important vector, has chiefly been found in ports and large commercial and industrial centres. Since Voroshilovsk in North Caucasus is an important point at which cereal crops of the region are concentrated and is situated close to districts in which epizootics occur, a survey of rats for the presence of fleas was carried out in and near the town from November 1934 to the end of 1935. From 819 examples of *Mus* (*Rattus*) *norvegicus*, which appeared to be the only rat occurring there, 927 fleas were taken, of which 73 per cent. were *C. fasciatus* and nearly 23 per cent. *X. cheopis*, the others being *Leptopsylla segnis*, Schönh., and one example each of *C. mokrzeckyi*, Wagn., and *Pulex irritans*, L. *X. cheopis* chiefly occurred in August and September, and on rats taken in houses situated along the railroad; it was practically absent on rats caught in the centre and the upper part of the town and was not found in villages. It is suggested that it was introduced with old sacks for cereals brought from infested towns in other parts of the Russian Union.

[MARIKOVSKIĬ (P. I.).] **Мариковский (П. И.). Eine neue Flohart (Aphaniptera) aus dem Fernen Osten.** [A new Species of Flea from the Russian Far East.] [*In Russian.*]—*Rev. Microbiol.* **15** (1936) no. 3–4 pp. 430–434, 4 figs., 2 refs. Saratov, 1937. (With a Summary in German.)

A detailed description is given of both sexes of *Stenoponia sidimi*, sp. n., taken in the southern part of the Ussuri region on the Siberian marten (*Mustela sibiricus coreanus*) and 7 species of wild rodents.

[SERGEEV (A. M.).] **Сергеев (А. М.). Die Uebertragung der Flöhe der Nagetieren durch Vögel.** [The Carriage of Fleas of Rodents by Birds.] [*In Russian.*]—*Rev. Microbiol.* **15** (1936) no. 3–4 pp. 435–438. Saratov, 1937. (With a Summary in German.)

Many of the birds that occur in the steppes shelter from the sun or strong winds in the burrows of rodents, and some, particularly species of *Oenanthe*, may nest in them. In the summer of 1934, 24 examples of *Oenanthe oenanthe* and five other birds were caught near burrows of *Citellus* in a district on the river Ural in western Kazakstan. Six rodent fleas were found on four of the examples of *Oenanthe* and one on another bird, the species being *Ceratophyllus tesquorum*, Wagn.,

Ctenophthalmus breviatus, Wagn. & Ioff, and *Neopsylla setosa*, Wagn. Since *O. oenanthe* often builds its nests in houses, it may be of importance in carrying fleas from burrows to dwellings.

[Bozhenko (V. P.).] **Боженко (В. П.). How long do the Mosquitos, *Culex apicalis* Ad., carry *Bacterium prodigiosum* in their Bodies?** [*In Russian.*]—*Rev. Microbiol.* **15** (1936) no. 3–4 pp. 439–444. 1 fig. Saratov, 1937. (With a Summary in English.)

With a view to studying the possible importance of mosquitos as carriers of pathogenic bacteria, experiments were carried out in 1935 in which adults of *Culex apicalis*, Adams, were allowed to engorge on a suspension of *Bacterium prodigiosum* in a saturated cotton pad and were then kept at 11–30°C. [51·8–86°F.]. Every two days or more, they were allowed to feed on a mixture of equal parts of defibrinated rabbit blood and 5–10 per cent. sugar solution. It was shown by culture that *B. prodigiosum* can survive in the bodies of the mosquitos for at least 27 days, is present in their faeces for up to 24 days, and survives in the faeces for at least 20 days after evacuation. Exposure of infected mosquitos to the sun in quartz flasks for 4 hours at 36–40°C. [96·8–104°F.] did not have any noticeable effect on the bacteria in them.

Of 10 larvae of *C. apicalis* kept for 24 hours in water infected with *B. prodigiosum* and then washed and transferred to fresh water containing aquatic vegetation, only 3 survived and gave rise to adults. Cultures of the dead larvae gave an abundant growth of *B. prodigiosum*, but the adults were not infected.

[Bozhenko (V. P.).] **Боженко (В. П.). On the Rôle of the Mosquitos, *Culex apicalis* Ad., as Carriers and Transmitters of Tularaemia.** [*In Russian.*]—*Rev. Microbiol.* **15** (1936) no. 3–4 pp. 445–449. Saratov, 1937. (With a Summary in English.)

Since mosquitos, especially *Culex*, invariably occur in places in Russia in which water rats [*Arvicola*] live, and since the latter harbour tularaemia [*cf. R.A.E.*, B **19** 85], experiments were undertaken to determine whether *C. apicalis*, Adams, which is widely distributed in the country, is able to carry and transmit the infection. The technique used was similar to that described in the preceding paper. It was shown that *Bacterium tularense* survives in the mosquitos for 24 days and is excreted with their faeces for 23 days. Fatal infections with tularaemia were produced in mice by injections of suspensions of infected mosquitos or their faeces, but no infection resulted when mosquitos fed on healthy mice or rabbits at intervals varying from a few seconds to 4 days after they had fed on the suspension of the bacterium. Of two mice that swallowed infected mosquitos, however, one died of tularaemia on the eighth day. It is suggested that the infection of animals by swallowing infected mosquitos is of considerable importance in the epidemiology of the disease.

[Zasukhin (D. N.).] **Засухин (Д. Н.). The Ticks (Ixodidae) and their Rôle in Epizootology and Epidemiology of Tularaemia in the South-East of U.S.S.R.** [*In Russian.*]—*Rev. Microbiol.* **15** (1936) no. 3–4 pp. 461–470, 2 maps, 50 refs. Saratov, 1937.

This is a discussion, based on the literature and on investigations near Saratov in 1936, on the rôle of Ixodid ticks in the transmission

of tularaemia in the south-east of European Russia. *Dermacentor silvarum*, Olen., appears likely to be the most important in this respect, since the larvae and nymphs infest water rats [*Arvicola*], which are the chief reservoirs of the disease [*cf. R.A.E.*, B **23** 139], as well as a number of other rodents that have often been found infected, while the adults may attack man and usually occur on domestic animals, including camels, which are subject to tularaemia. Experiments by Golov (1934) have shown that this tick can be infected with *Bacterium tularense*, does not lose the infection during development from one stage to the next, and can retain it in the adult stage for over 530 days. He considers that the most common way in which an animal becomes infected is by eating the ticks or their excreta, or by rubbing the excreta into the skin.

Other ticks that may be of importance in relation to tularaemia in the Department of Saratov are *Ixodes ricinus*, L. [*cf.* **24** 209], *Rhipicephalus schulzei*, Olen., and *R. rossicus*, Yak. & Kohl-Yak. Recent investigations by the author have shown that the last-named is more common, both on wild animals and cattle, than had been supposed.

[Golov (D. A.).] **Голов (Д. А.). Contribution to the Question of the Rôle of the Water Rat in the Epidemiology of Tularaemia.** [*In Russian.*]—*Med. Zh. Kazakstana* no. 1–2, 1935. [Alma-Ata, 1935.] (Abstr. in *Rev. Microbiol.* **15** (1936) no. 3–4 p. 483. Saratov, 1937.)

In Kazakstan, water rats [*Arvicola*] were found to be infested with lice of the genus *Hoplopleura*, which were most abundant in June–August. In experiments in which batches of 15 of these lice that had fed on water rats artificially infected with *Bacterium tularense* were transferred to healthy individuals, the latter died of tularaemia in 8–10 days. When lice from a water rat were placed on the back of the hand, they engorged readily, which indicates that they might transmit the infection to man.

Baltazard (M.). **Présence au Maroc d'un spirochète type** *duttoni* **transmis dans la nature par** *Ornithodorus erraticus*.—*Bull. Soc. Path. exot.* **30** no. 7 pp. 551–555. Paris, 1937.

A strain of spirochaetes highly pathogenic to rats and producing only an inapparent infection in guineapigs was isolated from examples of *Ornithodorus erraticus*, Lucas, taken from the burrows of *Meriones shawi* in the vicinity of Goulimine in southern Morocco. Although there was no evidence of cross-immunity between this strain and a strain of *Spirochaeta duttoni* var. *crocidurae* from Dakar [*cf. R.A.E.*, B **20** 139], the author considers it to belong to the group of *S. duttoni*.

Roubaud (E.), Colas-Belcour (J.) & Treillard (M.). **Hybridation naturelle de deux biotypes considérés comme amixiques de l'***Anopheles maculipennis* (**var.** *typicus* **et** *atroparvus*).—*Bull. Soc. Path. exot.* **30** no. 7 pp. 577–580, 1 ref. Paris, 1937.

Two fertilised females of *Anopheles maculipennis*, Mg., caught in nature in a stable in Normandy in March 1937 laid eggs that corresponded to those of race *maculipennis* (*typicus*). Adults of both sexes derived from these batches were kept in a room for about a week, and

females that had fed on a rabbit were then collected and allowed to oviposit. Some of them laid eggs having the characters of the typical race, but by far the greater number of the eggs were similar to those of race *atroparvus*, van Thiel. The eggs of the typical race were sterile, owing to the eurygamic habits of the females that laid them, whereas those of the *atroparvus* type were all fertile. A certain number of eggs showed intermediate characters, and there would appear to be no doubt that the original females were hybrids produced by the crossing of the typical race with race *atroparvus*.

Roubaud (E.), Stefanopoulo (G. J.) & Findlay (G. M.). **Essais de transmission par les stegomyies du virus amaril de cultures en tissu embryonnaire.**—*Bull. Soc. Path. exot.* **30** no. 7 pp. 581–583, 5 refs. Paris, 1937.

The experiments described were undertaken to determine whether the viscerotropic strains of yellow fever virus attenuated by culture on embryonic tissue that are now used for the inoculation of man against yellow fever had retained their transmissibility by *Aëdes aegypti*, L. Females of this mosquito that had engorged on monkeys (*Macacus rhesus*) inoculated with the various strains were allowed to feed on healthy monkeys, but subsequent sero-protection tests on these animals all gave negative results.

Galliard (H.) & Gaschen (H.). **Parasitisme d'*Anopheles hyrcanus* par les *Culicoides* au Tonkin.**—*Ann. Parasit. hum. comp.* **15** no. 4 pp. 320–322, 1 pl., 4 refs. Paris, 1st July 1937.

Seven examples of *Culicoides anophelis* Edw., were found attached to the abdomens of 3 examples of *Anopheles hyrcanus* var. *sinensis*, Wied. (one of which carried 3), and 2 of *A. hyrcanus* var. *nigerrimus*, Giles, collected in different parts of Tonkin ; the midges remained attached to the mosquitos for several hours. One of the examples of *A. hyrcanus* var. *sinensis* was also infested with unidentified mites. No midges were seen on any of the other species of Anophelines examined.

[Simić (Č.)] Simitch (T.) & [Kostić] Kostitch (D.). **Rôle de la mouche domestique dans la propagation du *Trichomonas intestinalis* chez l'homme.**—*Ann. Parasit. hum. comp.* **15** no. 4 pp. 324–325, 3 refs. Paris, 1st July 1937.

The authors describe experiments showing that it is possible for *Trichomonas intestinalis* to be carried mechanically by house-flies [*Musca domestica*, L.] from human or animal faeces to moist or liquid foodstuffs, either directly on feet or proboscis, provided that the interval between feeds does not exceed 10 minutes, or indirectly in the excrement, since, although it does not multiply in the intestine of the fly, it may survive there for 8 hours.

Schierbeek (R.). *Trombicula vanommereni* **n. sp. rouget nouveau de la Guyane néerlandaise.**—*Ann. Parasit. hum. comp.* **15** no. 4 pp. 326–329, 2 figs., 3 refs. Paris, 1st July 1937.

Examination of a number of larval mites that had been collected in the course of a year from man, fowls and lizards in the environs of

Paramaribo showed that most of them were *Trombicula flui*, van Thiel, but several belonged to a new species, *T. vanommereni*, sp. n. The characters distinguishing the two are given. No examples of *T. helleri*, Oud., were found among 1,453 mites, and the author concludes that it probably does not attack man [*cf. R.A.E.*, B **18** 215]. Of the mites taken on man, 2·5 per cent. were *T. vanommereni*; all those found on fowls were *T. flui*; and of 51 on lizards, 49 belonged to the former and 2 to the latter species. The author therefore suggests that *T. flui* is the species most likely to be identical with *T.* (*Acarus*) *batatas*, L., which was described from man [*cf. loc. cit.*].

SERGENT (Et.). **Oeufs d'*Anopheles maculipennis* de France et d'Algérie.**—*Arch. Inst. Pasteur Algérie* **15** no. 2 pp. 214–216, 3 pls., 3 refs. Algiers, 1937.

A study of the eggs of *Anopheles maculipennis*, Mg., from localities on the coast of Algeria and in Limousin [*cf. R.A.E.*, B **11** 172] has shown that the predominating races are *labranchiae*, Flni., and *atroparvus*, van Thiel, respectively [**23** 152]. It has also been found that the eggs of these two races cannot be identified with certainty by means of the appearance of the upper surface of the intercostal spaces of the float and that the float index]*cf.* **21** 211] of both is 0·35. However, they may be distinguished by the length of the egg, which averages 0·740 mm. in *labranchiae* and 0·716 mm. in *atroparvus*, by the number of intercostal spaces, which averages 14 in the former and 16 in the latter, and by the appearance of the columellae (papilles) on the upper surface of the egg [*cf.* **21** 137], which in *labranchiae* are irregular and resemble minute fragments of porcelain and in *atroparvus* are regular and appear like glass beads perforated in the centre; the columellae of the latter are less shiny. The width of the columellae in *labranchiae* is very variable and may be as much as 12μ; in *atroparvus* it varies only between 6 and 8μ.

COLLIGNON (E.). **Observations sur les gîtes à larves d'anophèles en Algérie (1936).**—*Arch. Inst. Pasteur Algérie* **15** no. 2 pp. 217–219, 1 map, 1 ref. Algiers, 1937.

A map shows the local distribution of the breeding places of *Anopheles maculipennis*, Mg., *A. hispaniola*, Theo., *A. algeriensis*, Theo., and *A. claviger*, Mg. (*bifurcatus*, auct.) in the Department of Algeria, based on collections of larvae made in 1936 in the course of the anti-malaria campaign. *A. maculipennis* is abundant and ubiquitous in the northern part of Algeria; a list is given of the localities where larvae of the other three species were found, showing the dates on which they were taken and the number of times they were found in association with larvae of *A. maculipennis*.

SERGENT (Ed.) & PONCET (A.). **Tableau de la répartition saisonnière des tiques les plus répandues en Algérie.**—*Arch. Inst. Pasteur Algérie* **15** no. 2 pp. 220–224, 3 diagrs., 9 refs. Algiers, 1937

The authors have examined more than 45,000 ticks of all stages, collected once a fortnight for 11 years in two localities in Algeria, one in the coastal plain and the other at an altitude of about 3,000 ft. in the high plateaux region. The species obtained were *Ixodes ricinus*, L., *Haemaphysalis cinnabarina punctata*, C. & F., *Hyalomma savignyi*,

Gerv. (*aegyptium*, auct.), *H. mauritanicum*, Senevet, *Rhipicephalus bursa*, C. & F., *R. sanguineus*, Latr., and *Boophilus* (*Margaropus*) *calcaratus*, Bir., and diagrams show the percentage of each species in the total, and the monthly distribution of all species together and of each separately.

DELPY (L.). **Les theilérioses bovines en Iran.**—*Arch. Inst. Pasteur Algérie* **15** no. 2 pp. 225–264, 2 pls., 5 figs., 32 refs. Algiers, 1937.

A detailed account is given of observations and experiments carried out to determine the forms of *Theileria* that occur in cattle in Persia. It is concluded that in addition to *T. mutans*, which is not pathogenic, there exists a form, only occasionally pathogenic to indigenous cattle but extremely virulent to imported animals, that may be considered a variety or strain of the species referred to as *T. annulata* by most authors but as *T. dispar* by Algerian workers [*cf. R.A.E.*, B **25** 250], who regard the former as a *nomen nudum*. The existing confusion in the classification of the genus *Hyalomma* is discussed [*cf.* **24** 196, etc.]. In view of this, it has not yet been possible to identify the species of *Hyalomma* that acts as vector of the disease, and it is considered inadvisable to attempt to classify the " species " of *Theileria* according to the species of *Hyalomma* by which they are transmitted.

HOVNANIAN (P.), JEBEJIAN (R.) & YENIKOMSHIAN (H. A.). **Dermal Leishmaniasis in a newly inhabited Section of Aleppo.**—*Trans. R. Soc. trop. Med. Hyg.* **31** no. 2 pp. 191–198, 1 pl., 2 figs., 2 refs. London, 31st July 1937.

An account is given of an outbreak of dermal leishmaniasis that occurred among a group of refugee immigrants in a settlement newly established outside the boundaries of Aleppo City during the autumn of 1935 and the winter of 1936. The people had been living for the previous 10 years or more in " camps ", in wooden or tin shacks, and the disease had not been prevalent. The camp ground had been clean and free of any kind of vegetation, and there had been no special complaints of sandflies [*Phlebotomus*]. The new houses were built of bricks made of straw and earth, material in which sandflies breed readily, in an area that had previously been an orchard. The ground was piled with rubbish and was still, in places, covered with undergrowth. During building operations in the summer and autumn of 1935, sandflies were abundant, but as construction progressed and the houses were plastered and the streets cleaned, their numbers gradually decreased and the outbreak subsided. No epidemic of the disease occurred in neighbouring settlements where the ground had not been cultivated, where there was no vegetation or rubbish, and where no large numbers of sandflies had appeared. Thus sandflies would appear to be the chief if not the only vector of the infection.

CORSON (J. F.). **The Virulence of *Trypanosoma rhodesiense* in relation to Cyclical Passage through *Glossina morsitans*.**—*Trans. R. Soc. trop. Med. Hyg.* **31** no. 2 pp. 251–254, 6 refs. London, 31st July 1937.

The following is taken from the author's summary : An experiment was made to compare the virulence of a strain of *Trypanosoma*

rhodesiense in two series of guineapigs, the infection being maintained in one series by cyclical transmissions by *Glossina morsitans*, Westw., and in the other by syringe inoculation. It was found that the virulence had increased in the latter series and apparently not in the former. This was confirmed by subinoculations into rats and mice. It was also found that this increased virulence was not decreased again by passage through *G. morsitans*.

JACK (R. W.). **Division of Entomology, Annual Report for the Year 1936.**—*Rhod. agric. J.* **34** no. 7 pp. 570–592; also as *Bull. Minist. Agric.* [*S. Rhodesia*] no. 1037, 23 pp. Salisbury, July 1937.

In the course of the medical and veterinary section of this report (pp. 576–592), J. K. Chorley gives an account of the situations in 1936 in the various localities in Southern Rhodesia where control measures against *Glossina morsitans*, Westw., are or have been carried out [*cf. R.A.E.*, B **24** 201]. In all, with the exception of the western portion of the Urungwe district, the fly has been eradicated over considerable areas covered by controlled game-reduction operations. No advances have been observed in places where, owing to the country being doubtfully suitable for advance, no operations were carried out. Only 19 cases of trypanosomiasis of cattle were recorded during the year, of which 6 were probably relapses. In consequence of the improvement, it has been possible to free the main tourist route to the Victoria Falls from all restrictions imposed on traffic by regulations under the Tsetse Fly Act [*cf.* **17** 162]. In addition, some of the open shooting areas have been abolished. In the southern fenced zone in the Doma area, approximately 1,400 head of native-owned stock have been introduced. Cattle running close to the middle fence, however, are within 8 miles of an area where a few flies are known to persist so that some cases of trypanosomiasis are almost certain to occur.

A survey in the Northern Mossurise District of Portuguese East Africa showed that *G. morsitans* is slowly spreading west through the low veldt and threatens to invade, at some future date, the low-lying Sabi Valley at the southern end of the Melsetter District [*cf.* **17** 211]; it will be difficult to construct a clearing in the low veldt that will be effective against this species. There has been an increase in the numbers of alien negroes found infected with sleeping sickness; most of the cases had entered the Colony on foot, passing through the northern fly belt on the way. A careful medical examination of all immigrant labour is the only means of preventing this.

The beneficial effect of the 35-mile anti-tsetse clearing along the Melsetter Border was very marked. As far as could be ascertained only 2 new cases of trypanosomiasis occurred in animals on the border farms and none on the farms away from the border.

In commenting on the report, R. W. Jack remarks that the game-reduction cordon has continued to confine the fly to country that is more or less useless for settlement, and that although reclamation is not the primary object, further areas were freed from fly during the year. In the Gwaai-Shangani area, it has once again been driven back to the north of the Shangani River, and the position is now substantially the same as at the conclusion of the four years' experiment begun in 1919 [*cf.* **11** 140]. At a conservative estimate, 250 square

miles of country have been cleared of permanent fly in this section since 1931. In the Gatooma section of the Hartley district, the fly has continued to recede westwards and now occupies only a relatively narrow strip, some 12 miles wide at its widest point, on the eastern side of the Umniati River. The sections of south-west Lomagundi and Gatooma both deal with one large salient from the main fly belt; at the end of the year this salient had been shortened by 20 miles and narrowed by about 15 on either side, the area cleared of permanent fly being roughly 1,200 square miles. A total of over 2,500 square miles has now been cleared of fly. The position in the south Melsetter district has continued to improve, presumably as the result of the border clearing against *Glossina pallidipes*, Aust. [*cf.* **24** 201].

The laboratory research work that has been carried out on *G. morsitans* during the year is briefly outlined. It is probable that the maximum shade temperature at low altitudes in the late dry season approaches very close to the point that is lethal to the fly; it may be excluded from certain regions on this account alone, and in others the death rate may be very high during the period of highest temperatures. It is possible that slight modifications of the environment, such as the destruction of undergrowth, may make it impossible for the fly to survive this critical period. Neither the adult nor the pupa of *G. morsitans* can withstand more than a few degrees of frost for a few hours; in certain parts of Southern Rhodesia sharp frosts are frequent and possibly cause a high mortality in otherwise suitable country. Clearing of undergrowth might prove useful in such localities in assisting frost to penetrate the pupal sites. It is also clear that during the latter part of the dry season, when the temperature is highest and the atmospheric humidity is very low, the flies need more frequent and regular meals, because they must replace the water lost from their bodies through evaporation by ingesting more blood [*cf.* **25** 93]. A scheme effective in breaking the contact between game and fly at this season might make continuous game destruction unnecessary. Examination of pupae collected in the field confirmed observations made in 1922–23 that at certain seasons they show a high rate of parasitism [*cf.* **18** 42], especially by species of the genus *Thyridanthrax*, although species of *Mutilla* are also present.

Several cases in which Merino sheep were infested by larvae of *Chrysomyia chloropyga*, Wied., were reported from the Melsetter district; larvae were found in the soiled wool round the anus of sheep suffering from scour and intestinal parasites. Of two cases of myiasis in young children, one was due to *Lucilia cuprina*, Wied., and one to *Cordylobia rodhaini*, Ged. *Ornithodorus megnini*, Dugès, was found in one locality on a horse bred in the Colony and in another on a pony imported from the Union of South Africa.

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). **L'aptitude de *Glossina palpalis* au développement de *Trypanosoma gambiense* est-elle rustique, raciale ou héréditaire ?**—*C. R. Soc. Biol.* **125** no. 23 pp. 1037–1039, 3 refs. Paris, 1937.

The experiments described were carried out at Leopoldville with two strains of *Trypanosoma gambiense* and examples of *Glossina palpalis*, R.-D., reared from flies caught in nature or bred for more than one generation in the laboratory. The results indicate that there is no

hereditary immunity from trypanosome infection in the progeny of infected flies, and that the rearing of flies in the laboratory has scarcely any effect on their ability to transmit *T. gambiense*.

THOMSEN (M.). **Fluerne og deres Bekæmpelse.** [Flies and their Control.]—23 pp., 11 figs. Aarhus, Dansk. Mejerinforen. Faelles-organis., October 1936. [Recd. September 1937.]

The greater part (pp. 1–21) of this popular account of flies and their control in Denmark [*cf. R.A.E.*, B **22** 230; **24** 43] is devoted to *Musca domestica*, L. All stages are briefly described, and methods of control are reviewed. The prevention of breeding by covering pig manure with cow-dung or with tarpaulins is described at some length [*cf. loc. cit.*]. The other flies, on which brief notes are given, are *Stomoxys calcitrans*, L., *Lyperosia irritans*, L., and *Haematobia stimulans*, Mg., attacking cattle.

HARDY (G. H.). **Notes on Genus *Calliphora* (Diptera). Classification, Synonymy, Distribution and Phylogeny.**—*Proc. Linn. Soc. N.S.W.* **62** pt. 1–2 pp. 17–26, 1 fig., 1 diagr., 6 refs. Sydney, 15th May 1937.

The author compares his grouping of species within the genus *Calliphora* with that of Patton [*R.A.E.*, B **23** 191], gives keys to his groups and to the species of the subgenera *Adichosia* and *Neopollenia*, attempts to identify 10 species of *Neopollenia* given in papers by Malloch, outlines the distribution of the subgenera *Adichosia*, *Neopollenia* and *Proekon*, discusses the phylogeny of the groups, and gives notes on the synonymy of 12 Australasian species, including three that have been confused, *viz. C. fallax*, Hardy, *C. rufipes*, Macq. (*hilli*, Patt.) and *C. milleri*, sp. n. *C. fallax* is only known definitely from Queensland and New South Wales, where it occurs mainly on the coast but also in the sheep-rearing country of both States. *C. rufipes* is known to the author only from Tasmania, Victoria and South Australia, where its distribution appears to be strictly limited to coastal regions. *C. milleri*, which is very briefly described, is confined to New Zealand, where it is the common blowfly known as *C. hilli*. The first and last species are certainly, and *C. rufipes* probably, associated with myiasis of sheep. The distribution of *C. laemica*, White, is limited to New Zealand, where it is associated with myiasis: all references to the occurrence of *C. stygia*, F., in New Zealand should be referred to this species.

MOORE (Walter). **The Chemical Control of the Sheep Maggot Fly (*Lucilia sericata* Meigen).**—*Scott. J. Agric.* **20** no. 3 pp. 227–240, 1 pl., 16 refs. Edinburgh, July 1937.

In connexion with investigations on *Lucilia sericata*, Mg., infesting sheep in Scotland [*cf. R.A.E.*, B 25 210, etc.], a study was begun in May 1933 on the possibility of efficient chemical control, and an account is here given of the work carried out and of the field surveys made to ascertain the main cause of strike and to account for the inadequacy for its control of present methods of dipping.

Clean, healthy sheep are rarely attacked by blowflies, so that some abnormal attracting substance must be present on the fleece of infested animals. Important sources of such substances are the soiling of the

fleece by urine and faeces, so that methods for the control of scouring must be an essential part of future work ; foot-rot, because the wool on the under surface of the chest region becomes contaminated with the discharge from the feet when the animal is lying down ; wool-rot, a form of bacterial activity, characterised by browning of the wool and the production of fly-attracting substances, that appears in the fleece of some sheep during periods of alternate sunshine and rain ; rabbits, since an experiment confirmed the suggestion that sheep lying in the shelter of rabbit burrows were struck because their wool had become soiled with rabbit faeces ; discharging wounds and sores, many of which are caused by using too strong a solution for dipping or dressing ; and dips that have become grossly contaminated with urine and faeces.

Present methods of dipping fail to control strike, because the common dips are water-soluble and so are readily washed off the fleece by rain, they do not penetrate to the skin, partly because insufficient time is allowed for immersion and partly because many dips have low wetting and penetrating properties, and sheep are rarely immersed for long enough to allow the dip to saturate faeces dried on the wool, and so the untouched parts continue to decompose and attract fly.

An effective dip should persist in the wool, possess high antiseptic and fly-repellent properties, have power to penetrate and wet the fleece, mix readily with water to form a stable emulsion, have no staining effect on the wool, and be cheap enough for commercial preparation. A brief account is given of the means by which a dip conforming to these requirements was evolved. The use of an oily emulsion was found to be the best way to ensure waterproofing, and the oil finally selected was a water-white mineral oil of over 98 per cent. purity with a specific gravity of 0·865, a viscosity of 130 sec. Redwood 1 at 70°F., and an open flash point of 330°F. This oil had no injurious effect on the skin of rabbits (on which it persisted for 3 weeks) nor on that of pigs dressed every 3 days for a month. A pale straw-coloured cresylic acid of 99 per cent. purity was selected as the antiseptic because it is soluble in the mineral oil, does not stain wool and is much more powerful than ordinary carbolic acid. Of the repellents tested, paradichlorobenzene and monochlornaphthalene showed the highest killing and repellent properties, but the former was chosen because, in a mineral oil emulsion, the latter injured the skin of rabbits. A black miscible oil type of emulsifier (Whitcol J.) formed a stable one-solution emulsion that penetrated the fleece very rapidly ; its wetting power was further enhanced by the addition of wool grease. The dip finally adopted is prepared by stirring together 38, 25 and 12 parts by weight of mineral oil, cresylic acid and crude brown Yorkshire wool grease, and warming until the wool grease is dissolved ; 25 parts by weight of paradichlorobenzene is added while the mixture is still warm (60–70°C. [140–158°F.]) and stirred at intervals until it is dissolved ; 4 parts by volume of rectified *Oleum picis* (pine tar oil), which promotes rapid healing of wounds and sores, and 30 parts of Whitcol J. are then added to 66 parts of the cooled mixture ; and finally, for use, one part of the mixture is diluted with 40 parts of water. The mixture does not comply exactly with the requirements of the Ministry of Agriculture for a sheep dip since it contains a higher percentage of tar acids than that specified but is deficient in tar oils.

The question of avoiding contamination of dips by spraying the dip on to the sheep is discussed ; and a description is given of a power

unit consisting of a petrol engine, pressure pump and 80-gallon tank, mounted together on a movable chassis for use with two galvanised chambers containing spraying jets, into which the sheep pass one at a time for treatment. Each cabinet can spray on to a sheep ½ gal. spray at 200 lb. pressure in 20 seconds. The outfit is so designed that it can be taken on a motor lorry to the sheep. Experiments showed that, with proper selection and placing of spraying nozzles, the depth of penetration depends on the spray used. Quick-breaking emulsions and dipping solutions with a high viscosity will not penetrate to the skin whether they are applied by spraying or by dipping. An emulsion with high penetrating power sprayed with a coarse jet soaks through to the skin immediately. Details are given of a number of experiments in which sheep treated with the oil emulsion used as a dip and as a spray were compared with those treated with an arsenical preparation that had been found to be the most effective proprietary dip for preventing strike, and with untreated sheep, and the general impression gained was that the emulsion was definitely superior to the water-soluble dip in that it was not so easily washed off by rain. For treating cases where wool-rot is the main cause of strike, it has definite advantages, and it appeared that when it was properly applied it greatly reduced strike.

The properties of an effective dressing are enumerated. Early experiments showed that none of the existing treatments was satisfactory. The dressing finally evolved contains the same ingredients as the emulsion with the exclusion of the emulsifier (Whitcol J.) (the percentages of oil, cresylic acid, wool grease, paradichlorobenzene and pine tar oil being 71, 4, 10, 5 and 10, respectively) and is prepared in the same way. It has been extensively used for two years with excellent results. One treatment is usually sufficient when the maggots are living in the wool, but when they occur in wounds these should be drained of pus and dressed daily until a skin forms upon the surface. In 1936, over 1,000 sheep were treated with the dressing and, with the exception of 9 cases, strike only recurred when bags of pus were present in the wounds.

The disadvantages of the usual treatments for foot-rot are discussed. To be effective, the substance used must persist for some time even under wet conditions. The cheapest method of application is to allow the sheep to walk through a bath. A waterproof dressing that can be applied in this way was made by dissolving 4 parts ordinary creosote in 96 parts fuel oil ; the oil acts as a waterproofing agent and as a carrier for the antiseptic. The surplus dressing can be retained in a foot-bath for a considerable period without any loss from evaporation or fear that the animals will drink it. A flock of 300 sheep among which foot-rot was the prime cause of strike was made to walk through a 20-ft. bath containing this dressing once a week for a month. Strike was reduced from 18 to below 2 per cent., and, except in a few severe cases, the foot-rot appeared to be completely cured.

WILLE (J.), OCAMPO (J. A.), WÉBERBAUER (A.) & SCHOFIELD (D.). **El cube** (*Lonchocarpus nicou*) **y otros barbascos en el Peru.** [Cubé and other Barbasco Plants in Peru.]—*Bol. Estac. exp. agric. Minist. Fom. Peru* no. 11, 117 pp., 23 pls., 163 refs. Lima, June 1937.

Part of this paper [*cf. R.A.E.*, A **25** 760] deals with the use of cubé (*Lonchocarpus nicou*) in dips against *Melophagus ovinus*, L., and

Sarcoptes sp. on sheep, *Haematopinus eurysternus*, Nitzsch, on cattle, *H. suis*, L., on pigs, and a species of *Psoroptes* on alpaca in Peru. In 1935 more than 300,000 sheep were treated with cubé dip in the Junín region, and 150,000 in that of Puno. The dips were obtained either from an extract prepared by soaking the chopped roots in water for 48 hours, or from a powder finely ground so that 85 per cent. passed a sieve of 0·074 mm. mesh. Their practical application was studied in 1936 by J. F. Mitchell, who stated that the powder yielded a dip that was more saponaceous, and therefore penetrated better, than that from the extract. Dips made with the powder did not keep for more than 48 hours, a disadvantage owing to the number of animals to be treated, whereas those made with the extract kept for up to a week. The addition of ½ lb. soap per 100 U.S. gals. was recommended, and also that of ½ lb. sodium carbonate to counteract the hardness of the water. For complete control of the parasites, cattle usually required two dips, with about a fortnight's interval, twice a year, and sheep the same, except when seriously infested, in which case a third pair of dips was necessary.

The effective concentrations of ground root containing 6·8 per cent. rotenone, and of extract containing 5·5 per cent. rotenone were, respectively, 1 : 2,000 and 1 : 10,000 for *M. ovinus*, 1 : 3,000 and 1 : 15,000 for *H. eurysternus*, 1 : 2,000 and 1 : 8,000 for *H. suis*, and 1 : 1,000 and 1 : 5,000 for *Sarcoptes* sp. and *Psoroptes* sp. The ground root and the extract were equally effective, and were in no way inferior to other dips.

In preliminary tests, cubé root containing 5 per cent. rotenone had no effect on the larvae of *Anopheles pseudopunctipennis*, Theo., after 15 hours, when used at a concentration at which it killed fish in 30 minutes.

Clarke (C. H. D.). **American Dog Tick,** *Dermacentor variabilis* **Say, in Ontario.**—*Canad. Field Nat.* **51** no. 7 p. 99, 4 refs. Ottawa, October 1937.

Dermacentor variabilis, Say, was taken on a dog in Ontario in 1935. There is apparently only one previous record of its occurrence in the Province.

Emmel (M. W.). **Sulfur in the Control of external Parasites of Chickens. Preliminary Report.**—*J. Amer. vet. med. Ass.* **91** no. 2 pp. 201–204, 1 ref. Chicago, Ill., August 1937.

The author describes experiments in Florida in which infestations of *Menopon gallinae*, L., and *Eomenacanthus* (*M.*) *stramineus*, Nitzsch, on fowls were controlled by adding 5 per cent. sulphur to the mash on which they were fed. On fowls that had access to sunshine, no living lice were found at the end of three weeks, although lice on the control birds showed no visible decrease in numbers. When the feathers of the treated birds were ruffled back, a distinct odour of sulphur dioxide was detectable, which was faint at the end of one week and strongest at the end of three. In an experiment in which the treated birds were kept indoors, hardly any odour was detectable at the end of three weeks and the infestation of lice was reduced by only 25 per cent.; but when the same birds were placed in outside cages, the odour of sulphur dioxide was noticeable at the end of two days and all the lice

had disappeared at the end of a week. After fowls had been fed continuously for 6–8 weeks on food mixed with 5 per cent. sulphur, the odour of sulphur dioxide was, in general, not so pronounced and implanted infestations of lice were controlled much more slowly, an observation suggesting that intermittent feeding on sulphur may be more effective in controlling lice than continuous feeding over long periods of time. The skin of treated birds became markedly scaly and considerable epithelial débris was observed; the intensity of the condition was sometimes reduced when feeding was continued. A "puffed" appearance often developed round the eyes, and the surface of the comb and wattles became scaly, so that they appeared greyish in colour.

In two experiments, fowls heavily infested with *Echidnophaga gallinacea*, Westw., were fed on 5 per cent. sulphur, the yards were treated with sulphur at the rate of 100 lb. to 400 sq. ft., and the floor of the houses under the litter was lightly coated with the same material. Several days later, the fleas began to drop from the birds and at the end of three weeks complete control had been obtained and feeding on sulphur was discontinued. No reinfestation had occurred at the end of four months in either experiment.

A lawn, 75 ft. square, heavily infested with *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., was completely freed from fleas by applying 100 lb. sulphur, and it remained uninfested except for a few days following rain two weeks after the application. Lime (300 lb.) was applied two months later to counteract the acidity produced by the action of the sulphur, and no injurious effects were observed on the lawn. Direct contact with sulphur killed adult fleas in 5–10 minutes at room temperature, and fleas held an inch above sulphur died from the effects of the fumes in several hours. In both cases death occurred sooner at 37°C. [98·6°F.].

Two lots of fowls infested with *Argas persicus*, Oken, were treated in the same way as those infested with *E. gallinacea*. The infestation was reduced but not so rapidly. No reinfestation occurred after the birds had become free from ticks. Direct contact with sulphur at room temperature failed to kill the adult ticks, and it is thought that the sulphur so increased the acidity of the soil that it became an unfavourable environment for the development of the immature stages; as free sulphur exists in the soil for some time after treatment, direct contact with it may also have had some effect. Three poultry houses infested with *Dermanyssus gallinae*, DeG., were cleaned, and sulphur was placed on the floors, dropping-boards and nests to a depth of about $\frac{1}{16}$ inch and worked into the cracks with a broom. The mites had disappeared at the end of a week. The application of sulphur was effective in a poultry house with an earthen floor, and, in one instance, dusting sulphur on the litter and beneath the nesting material proved effective.

Johnson (E. P.). **Transmission of Fowl Leukosis.**—*Poult. Sci.* **16** p. 255. Ithaca, N.Y., 1937. (Abstr. in *J. Amer. vet. med. Ass.* **91** no. 2 p. 223. Chicago, Ill., August 1937.)

Evidence is submitted to show that mites (*Dermanyssus gallinae*, DeG.) can transmit the causal agent of leucosis in fowls from infected to healthy birds under conditions indicating that this may be one of

the means by which transmission takes place in nature. Five out of 16 birds exposed to infestation by mites that had fed on an infected bird developed the disease.

LAGOS (L. M.) & CANEVARI (J.). **Fauna entomológica del palomar** [Pigeon House]. **I.** *Pseudolynchia maura* **Bigot.**—*Rev. Soc. ent. argent.* **8** (1936) pp. 77–80, 1 pl. Buenos Aires, 1937.

In 1935, the Hippoboscid, *Pseudolynchia maura*, Big., was observed in small numbers on pigeons in Buenos Aires. Notes from the literature are given on its classification, morphology and bionomics.

BOURQUIN (F.). **Notas biologicas sobre** *Megalopyge urens* **Berg (Lep. Megalop.).**—*Rev. Soc. ent. argent.* **8** (1936) pp. 125–132, 3 pls., 2 refs. Buenos Aires, 1937.

Descriptions are given of all stages of *Megalopyge urens*, Berg, which has one generation a year and is common on planes and elms and in rose gardens in Montevideo and in parts of Argentina. The irritation set up by the urticating hairs of the larvae may cause fever in young children. Notes are given on the biology of this Megalopygid, in which the larval stage lasts about 9 weeks.

DE MEILLON (B.). **A Cage Colony of** *Anopheles gambiae* **Giles.**—*Nature* **140** no. 3540 p. 428, 1 ref. London, 4th September 1937.

The author has succeeded in establishing a colony of *Anopheles gambiae*, Giles, in the laboratory at Eshowe, Zululand. Adults reared from eggs laid by gravid females caught in the field were placed in an indoor cage lined with asbestos, measuring 6 ft. by 5 ft. by 5 ft. The temperature in the cage was kept constant at 25°C. [77°F.] by means of a radiator connected with a thermostat. Large bird baths and ferns were placed inside, yet the humidity of the air never rose above 40 per cent. The females were given an opportunity to feed on man every evening for a month, and although they seldom fed, nearly full-grown larvae were seen in one of the bird baths at the end of this time and robust adults were subsequently produced. A small pig was then introduced into the cage and the mosquitos fed readily; eight days later first-instar larvae were observed. Since that time hundreds of larvae have hatched, and adults of the third generation were ready to deposit eggs at the beginning of August 1937.

KRISHNAN (K. V.). **Report of the Professor of Malariology and Rural Hygiene.**—*Rep. All-India Inst. Hyg. publ. Hlth 1936* pp. 29–35. Calcutta, 1937.

In the course of this report, the author discusses the possible reason why *Anopheles culicifacies*, Giles, which is generally considered to be the chief vector of malaria in India, is of little or no importance in Bengal. As adults from Singhbhum [Bihar], and from Abujhati (Bengal) became infected to the same extent when fed on gametocyte carriers and the parasites in both batches developed to the sporozoite stage, it seems unlikely that the inability of the species to act as a vector in Bengal is due to a difference of race. On the other hand it may be due to the fact that its seasonal incidence has been found to be very

restricted ; both larvae and adults were taken between January and March but none was seen later [*cf. R.A.E.*, B **23** 18]. During late winter and early spring, the number of gametocyte carriers is low and conditions of temperature and humidity are unfavourable for the extrinsic cycle of the malaria parasite. The reasons why the species is unable to breed throughout the year in Bengal are not quite clear. Larvae from eggs imported from Singhbhum during the period July to December (the malaria season in Bengal) were successfully reared in clear water above a layer of sand, but under the natural conditions prevailing at that time in Bengal, when the breeding waters are muddy and contain a certain type of aquatic vegetation, breeding was very difficult. It would appear that the temperatures during this period are also unfavourable.

[SOKOLOV (N. P.).] **Соколов (Н. П.). Ecological Methods of Control of the Mosquito Larvae of the Genus** *Anopheles*. [*In Russian.*]—*Social. Sci. Tech.* **4** (1936) no. 11 pp. 116–118. Tashkent, 1937.

This is a brief survey of data on the use of *Gambusia* against Anopheline larvae in various parts of the world, based on the literature and the author's experiments [*R.A.E.*, B **25** 32].

BATES (M.). **The Seasonal Distribution of Anopheline Mosquitoes in the Vicinity of Tirana, Albania.**—*Riv. Malariol.* **16** (1) fasc. 4 pp. 253–264, 12 graphs, 6 refs. Rome, 1937. (With a Summary in Italian.)

In this paper, the author summarises and discusses the results of weekly catches in 1933–36 of Anophelines in two cow-houses near Tirana, Albania. The results for five species are illustrated by graphs. The curve for *Anopheles maculipennis*, Mg., had one peak in the year, about 1st July, followed by a fairly rapid decline, though maintaining a moderately high level, and sometimes increasing again, in August. The species was represented by two races, *maculipennis* (*typicus*) and *subalpinus*, Lewis & Hackett [*R.A.E.*, B **24** 36]. From figures for the average number of egg-batches laid by each race, it appears that *subalpinus* remains at a moderately low and even level of abundance through the summer, the big increase in the species being due to the typical race. The single mode of the curve for *A. maculipennis* at Tirana and three other localities in Albania contrasts with the bimodal distribution of the other Anophelines in Albania and with that of *A. maculipennis* itself in Spain [**21** 26]. It was noticed that in 1935, the year of greatest abundance of *A. maculipennis*, the driest summer and the highest mean June temperature occurred ; that in 1933, when the peak was in July, the mean temperature in May, June and July was unusually low ; and that in 1934, when the peak occurred unusually early, the mean temperature in April and May was unusually high.

A. sacharovi, Favr, first appeared about the beginning of July and then gradually declined in numbers through August and September. This curve is complementary to that in coastal regions, where the peak is in June, with a drop in July. It is possible that *A. sacharovi* is not established round Tirana, but comes in during the great increase in numbers in the coastal marshes and dies out after a few generations.

A. superpictus, Grassi, had widely differing curves for the four years. In the Tirana region, it breeds in pools in the river bed, and the larvae are probably liable to be destroyed by floods, which are very irregular. Its optimum appears to be a dry summer that leaves the pools undisturbed. The distribution of rainfall and the curves of abundance of *A. superpictus* were both similar in 1933 and 1936. In 1934, when rains continued through the summer, there was no autumn peak, and the year 1935, with the earliest dry season, had a very early peak. The data for the four years indicate a tendency to form a low peak about 1st May, and a much higher one in August.

The curve for *A. claviger*, Mg., had a very high autumn peak, recurring regularly in the first or second week in November. The median position of the spring peak seems to be about 1st May. Figures for *A. plumbeus*, Steph., are available for 1936 only. The individuals found in one cow-house probably came from a small grove of oaks nearby ; only a single example was caught in the other during the year. The curve showed a low peak in the second half of April and a higher one at the end of August. *A. plumbeus* was easily bred, and, contrary to other findings [**24** 112], many hundreds of larvae were reared at a constant temperature of 27°C. [80·6°F.], in rainwater containing some blood serum, with practically no mortality, though they gave rise to small-sized adults. Larvae of the other species of Albanian Anophelines died under similar conditions.

A. algeriensis, Theo., was observed in very small numbers in 1936.

CORRADETTI (A.). **Sulla composizione della fauna anofelica in relazione ai diversi gradi di bonifica nella valle del Lemene (Veneto).** [On the Composition of the Anopheline Fauna in Relation to the various Degrees of Reclamation of the Lemene Area, Venetia.]—*Riv. Malariol.* **16** (1) fasc. 4 pp. 265–275, 2 maps. Rome, 1937. (With a Summary in English.)

The presence in a given locality of an Anopheline vector of malaria depends on the physical and chemical factors in the soil and water. Land reclamation work must be based on a study of the relationship between endemic malaria, the Anophelines present and their larval habitats in order to ensure changes in the latter that preclude the breeding of dangerous forms. In this paper, the author considers these points in connection with reclamation in the Lemene area of the Venetian coast. The following is taken from his summary : The adults of *Anopheles sacharovi*, Favr (*A. maculipennis* var. *elutus*, Edw.), which is the vector of malaria in this region, occur abundantly in zones of retarded reclamation and decrease to vanishing point as reclamation is more advanced. The percentage of this species among the Anophelines taken diminishes with increasing distance from the salt marsh that is its breeding focus. As the Anophelines in a given zone are in part indigenous and in part migrants from adjoining zones, it is probable that *A. sacharovi* is not indigenous in zones of advanced reclamation in which it has been found. Further study of breeding places should show the stage of reclamation at which it is precluded from developing. *A. maculipennis*, Mg., race *maculipennis* (*typicus*) is very abundant in all the zones ; it predominates in those advanced in reclamation and was the only Anopheline taken at some stations. Race *messeae*, Flni., occurred everywhere in the region, but only in small numbers.

Gil Collado (J.). **La distribución geográfica de las variedades de** *Anopheles maculipennis* **en España, con breves consideraciones acerca de su biología.** [The Distribution in Spain of the Varieties of *A. maculipennis* with brief Notes on their Biology.]—*Riv. Malariol.* **16** (1) fasc. 4 pp. 276–289, 1 map. Rome, 1937. (With a Summary in Italian.)

From an examination of about 4,000 egg-batches, the distribution in Spain of the four races of *Anopheles maculipennis*, Mg., that occur there was found to be as follows: race *maculipennis* (*basilei*, Flni.) was found only in one village in the north-east; *melanoon*, Hackett, was the only race that occurred in the rice-fields on the east coast, where there is little or no malaria; *labranchiae*, Flni., was an effective vector, but was confined to a small region in the provinces of Murcia and Alicante; and *atroparvus*, van Thiel, occurred over almost the whole of Spain, both in districts free from malaria and in those in which it is endemic and was evidently the most adaptable of the races. The Spanish forms agree with those in Italy, but some morphological details of eggs, larvae and adults that are helpful in identification are described. The exclusive occurrence of *melanoon* in the south of the rice-field coastal belt, its admixture with *atroparvus* in the centre of this belt and its replacement northwards by *atroparvus* are ascribed, not to the slight differences in temperature, but to biological competition between the two forms [*cf. R.A.E.*, B **21** 228]. In the south, rice has been cultivated for a very long period, in some places from the time of the Moors, and the resulting favourable conditions for *melanoon* have enabled it to overcome and replace *atroparvus*; in the centre of the belt, rice was introduced about 80 years ago; in the north, it is still more recent. It has been stated [**22** 201] that *melanoon* has little contact with man, but the author and others have found it to bite man readily, and its slight importance as a malaria vector is ascribed to physiological peculiarities. For instance, whereas *atroparvus* can oviposit 3 or 4 times in the laboratory, *melanoon* has difficulty in doing so even twice. Should this occur in nature, its adult stage would be shorter than that of *atroparvus*.

The fact that *atroparvus* is associated with malaria in some localities and not in others may be due to variations in its biology. The author observed that in Spain malaria seems to occur not in direct relation to the abundance and extent of the pools able to maintain a large Anopheline population, but actually inversely to it. For instance, in Cáceres, which is possibly the most malarious region in Spain [*cf.* **23** 190], there are many villages in which, owing to the excessive drought, there is barely enough water to form small breeding places. Such places produce adult mosquitos of small size and generally with a fairly low maxillary index, denoting a morphological modification due to high water temperature, poverty of aquatic vegetation and plankton, over-population of Anophelines, superabundant bacteria and brackishness. The author suggests that the morphological changes in the Anophelines are accompanied by physiological changes of which little is known. These may possibly be retarded ovarian development and increased feeding to compensate for deficient larval nutrition; both these conditions would favour the propagation of the malarial parasite, as there would be a longer period in which it could develop and greater risk of the mosquito becoming infected.

Soper (F. L.). **The geographical Distribution of Immunity to Yellow Fever in Man in South America.**—*Amer. J. trop. Med.* **17** no. 4 pp. 457–511, 16 maps, 23 refs. Baltimore, Md, July 1937.

In this paper are given the results of a survey of immunity from yellow fever carried out by means of the mouse-protection test on blood specimens collected from localities in all countries of South America, except Argentina and Uruguay.

The following is largely taken from the author's summary: The reported incidence of yellow fever is not a safe index of its occurrence in endemic zones. Although visible outbreaks in urban and maritime localities may decline, or even cease entirely for a time, there is a vast reservoir of infection in the interior. Infection transmitted by *Aëdes aegypti*, L., has been much more widespread in the interior of north-eastern Brazil than was previously believed (even though this area has long been under special observation), and did not disappear spontaneously following the organisation of measures against *A. aegypti* in the principal centres of population. The disease is endemic not only on the coast of north-eastern Brazil, as was believed, but over the whole country, except a few of the southern States, and also in Bolivia, Paraguay, Peru, Ecuador, Colombia and Venezuela, including many sparsely populated jungle districts where *A. aegypti* does not occur. The percentages of immune persons have been found to vary widely in proved endemic regions, being apparently high in those areas where transmission is due to *A. aegypti* and low where it takes place in the absence of this mosquito. There is no evidence of recent outbreaks in any of the important Caribbean or Pacific ports.

Papers noticed by Title only.

Anduze (P.). **Historia y distribución geográfica de los zancudos** [mosquitos] **en Venezuela.**—*Bol. Soc. venezol. Cienc. nat.* **3** no. 26 pp. 307–312. Caracas, 1936.

Denning (D.). **First Record of the Black Widow Spider** [*Latrodectus mactans*, F.] **in Minnesota.**—*Science* **86** no. 2233 p. 350. New York, 13th October 1937.

Sugimoto (M.). **On the Nymph and Larva of the Formosan Large Tick,** *Amblyomma testudinarium* **Koch, 1844.**—*Trans. nat. Hist. Soc. Formosa* **27** no. 160 pp. 1–4, 2 pls. Taihoku, January 1937.

Sugimoto (M.). **On a new Species** (*Ixodes shinchikuensis* **sp. nov.**) **of Tick from the Formosan Dog.**—*Trans. nat. Hist. Soc. Formosa* **27** no. 162 pp. 59–61, 1 fig., 8 refs. Taihoku, March 1937.

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* For relation to disease see under *Bacillus leprae*, Bacteria, Blackwater Fever, Dengue, Encephalomyelitis (Equine), Filariasis, Fowl-pox, Malaria, *Spirochaeta gallinarum*, *Trypanosoma gambiense*; Yellow Fever.

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